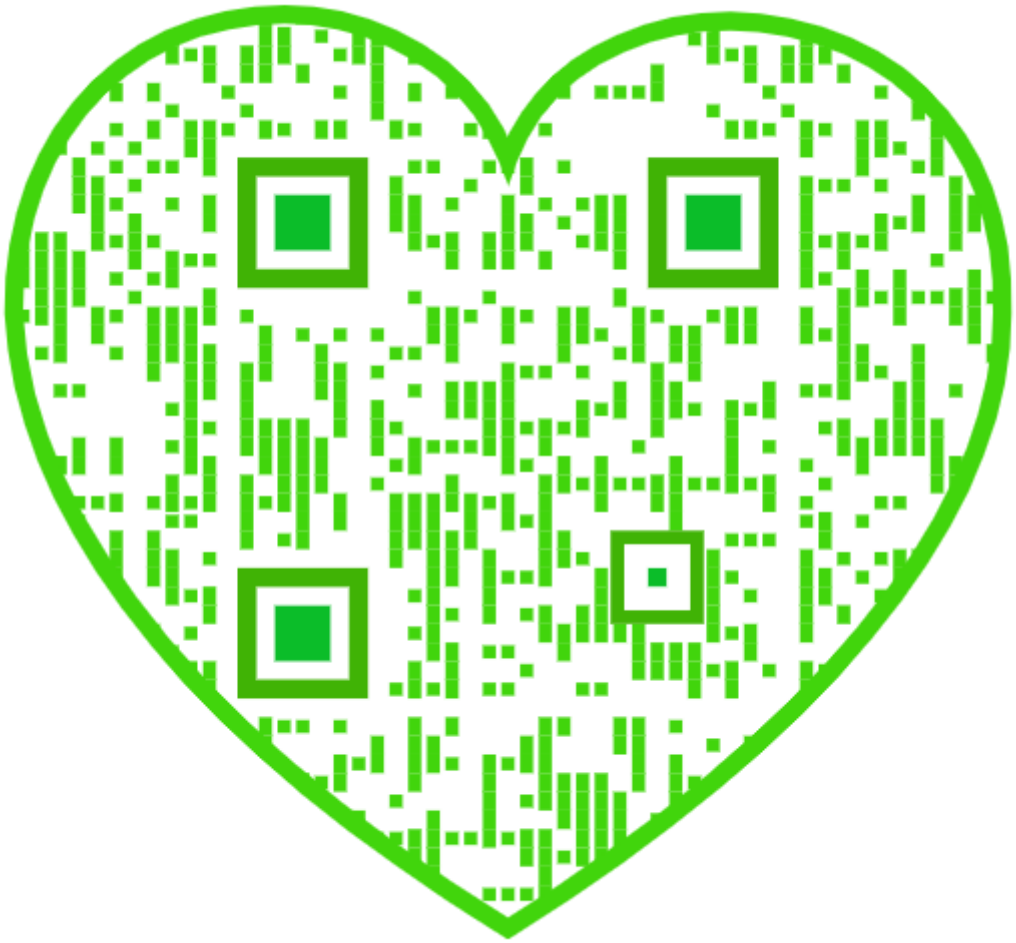
ANIMAL MAGNETISM



ANIMAL MAGNETISM

PHYSIOLOGICAL OBSERVATIONS

BY

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TRANSLATED FROM THE FOURTH GERMAN EDITION BY

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WITH A PREFACE BY

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PREFACE.

HAVING been requested by the publishers to write a short preface to the following translation for the purpose of introducing an interesting work to the notice of English readers, I think it desirable to say that, not having had an opportunity of reading the translation, I am acquainted with the work only in its original language. But although I am thus unable to form an independent opinion on the merits of the translation as such, I have no doubt that it has been well done; for the translator informs me that his task was undertaken at the suggestion of Professor Ludwig, and it scarcely requires to be said that a suggestion of the kind from this source is a sufficient guarantee of the competency of the man to execute the work suggested.

Regarding the research itself, I feel it needless

to say much. If we consider the length of time that so-called "mesmerism" or "electro-biology" has been before the world, the remarkable nature of the phenomena, and the amount of interest—not to say superstition—which they have excited, we can scarcely fail to wonder that so inviting a subject should not long ago have been worked out by men of science. And in whatever measure we feel it is desirable that so remarkable and obscure a class of phenomena should be properly investigated, in that measure must we feel how fortunate it is that their investigation should at last have been undertaken by a physiologist so well known as Heidenhain. The more extraordinary or unusual the facts may be found, after due investigation, to be, the more important it is that their nature as facts should be attested by a man who, like the present author, holds a universally recognized position in the foremost rank of investigators. The truth of this consideration will become apparent to every one who first encounters some of the statements contained in this little treatise—such, for instance, as those with regard to imitative speaking. If such statements were to occur in the writings of any ordinary observer, they would be at once dismissed—and rightly dismissed—as much too improbable for acceptance. But when they

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Athanasius Kircher communicated to a fowl when he made the animal lie motionless upon the ground with its beak resting upon a chalked line, or which Czermak communicated to a cray-fish when he made this animal to stand motionless upon its head.

The hypothesis which Braid suggested may also be set aside, as at all events insufficient to explain the primary facts, or those of the hypnotic sleep. He regarded the latter as probably due to a disturbance of the cerebral circulation; but, without too hastily dismissing this view as having a possible application to some of the secondary facts, or those which follow upon the hypnotic sleep, it seems evident that it cannot apply to the primary. For not only have the researches of Heidenhain tended to its negation, but the circumstance of so many animals being susceptible to hypnotism which present such different types of circulatory apparatus, appears to constitute definite proof that it is not to the circulatory system we have to look for our explanation of hypnotism.

What we require for our explanation to stand upon is some principle of physiology that is known to apply to all the animals which are found to be susceptible to hypnotism. Such a principle is supplied by what is called inhibition—a principle

which is known to have a very general application to the nerve-centres of various species of animals, and to which, therefore, most of the more modern investigators of hypnotism have pointed as the probable explanation of the facts. And there can now be little or no doubt that this is the source from which the explanation is to be sought. But when we have said this we have said all. For it appears evident that, although we perceive the direction in which we are, with most promise of success, to seek the explanation, the explanation itself, in any full or scientific sense of the word, is still a thing of the future. And here I approach the only criticism to which I think the following pages are open. In his desire to graft the facts which he details upon the growing structure of physiological knowledge, Heidenhain seems too ready too gloss over the difficulties which attend the attempted assimilation. As a matter of fact, no physiologist from his previous knowledge of inhibition, could possibly have anticipated any one of the facts which are detailed in this book; and now that they are in our possession, we are for the most part unable to see how they are connected with anything that we previously knew concerning the facts of inhibition. The truth appears to be that in hypno-

tism we are approaching a completely new field of physiological research, in the cultivation of which our previous knowledge of inhibition may properly be taken as the starting-point. But further than this we must meanwhile be content to collect facts merely as facts ; and, without attempting to strain these facts into explanations derived from our knowledge of less complex nervous actions, we must patiently wait until explanations which we can feel to be adequate may be found to arise.

GEORGE J. ROMANES.

AUTHOR'S PREFACE

TO THE FOURTH EDITION.

THE first part of the present edition is essentially a reproduction of a lecture delivered at the general meeting of the Silesian Society, a fortnight after Herr Hansen, the mesmerist, had commenced his performances in Breslau.

In the earlier editions the lecture appeared entirely in its original form, but in the present one, there are a few slight alterations.

Our knowledge concerning the "magnetic" state was, at that time, very limited. Since then it has undergone considerable increase, and it would, perhaps, have been better to remodel the lecture so as to introduce the new facts which have already been published in the second and third editions. But there can be no doubt that there is still much room

for observation in this subject. It has, therefore, been considered useless to attempt, for the present, a complete description of hypnotism. Hence the original lecture, which has formed the starting-point of our researches in this new field of investigation, has been once more published.

Such new observations as have been made, have been brought forward in the form of an appendix; no further development of the theory of hypnotism having been attempted.

Professor Weinhold's pamphlet on hypnotism, which was published long before our own, can be strongly recommended to those who wish to pursue further the study of this subject.

R. HEIDENHAIN.

BRESLAU, *March* 23, 1880.

PART I.

LECTURE DELIVERED AT
THE GENERAL MEETING OF THE SILESIAN
SOCIETY FOR HOME CULTURE,
19TH JANUARY, 1880.

ANIMAL MAGNETISM.

I HAVE willingly acceded to the request of the president of this Society, to give some explanation of the very wonderful and interesting performances of Mr. Hansen, the mesmerist; for it seems to me to be a point of public interest to endeavour to prevent the remarkable phenomena, which most of you have witnessed, being falsely interpreted—interpreted to prove the existence of some secret, at present unknown, force.

The fear that this could occur is in truth well grounded. The so-called spiritualism, in spite of all the scientific enlightenment of the age, still runs in the heads of not merely unscientific people, but also of earnest and distinguished *savants*.

One of them indeed has, with Mr. Slade's assistance, summoned spirits, and even photographed their footsteps.

To our old and evident three dimensions in space, a fourth invisible one has been added, into which, objects of three dimensions, tables, etc.,

disappear before our very eyes; and out of which, lumps of coal, thrown by invisible hands, fly round the heads of the astonished spectators; limbs without trunks come into view; and other marvels.

A well-known philosopher has *bonâ fide* declared these fables to be a new revelation of Almighty Power, intended to awake unbelieving mankind to new faith.

In an age in which this is possible, the danger that phenomena such as Mr. Hansen displays may lead to a new form of superstition, is imminent.

As is well known, Mr. Hansen makes the persons upon whom he experiments stare fixedly at a faceted and glittering piece of glass. After this preliminary proceeding, he makes a few "passes" over the face, without, however, touching it; then lightly closes the eyes and mouth, accompanying the latter process with gentle stroking of the cheeks. The "media" are now incapable of opening eyes or mouth; and, after a few more passes over the forehead, fall into a sleep-like condition.

In this state they are exhibited by Mr. Hansen as will-less automata, who, at his command, assume all kinds of positions, and perform the most unreasonable and ridiculous actions, such as eating a raw potato, under the impression that it is a pear; riding cross-legged on a chair, under the

idea they are riding in a horse-race; each, in fact, being apparently entirely subject to control.

The spectator is at a loss for an explanation, and finally arrives at the very reasonable conclusion that the whole affair is nonsense; or, if his scientific convictions are less sound, feels he is really in the presence of a new natural force, by virtue of which the experimenter exerts over the will and actions of his media some undefined influence.

As will be often enough shown in the sequel, both these conclusions are false.

I myself, when I first read reports of Hansen's representations, came to the first of the above-mentioned conclusions. I was certainly somewhat shaken in my opinion by a recent pamphlet by Professor Weinhold, of Chemnitz, whom I personally know as a thoroughly careful and unprejudiced observer, and whose statements are certainly free from intentional fraud.

But when Mr. Hansen, in this town, before an assemblage of physicians who had hitherto been absolute disbelievers on the subject, was able to perform his experiments with success on several of these very men, I entirely altered my opinion.

I soon got the opportunity of more narrowly investigating the phenomena I had then witnessed; as I succeeded in throwing into the condition seen in Hansen's media, a number of medical men and

medical students, among others a student brother of mine — persons whose credibility is beyond question, and who are all well fitted to give the best description of their own perceptions.*

Partly from my own researches, partly from observation of friendly colleagues—especially Drs. Grützner and Jänicke, who, after oral explanation, were able successfully to "magnetize"—a number of facts have been collected which throw light on the *hypnotic* condition. I, with Weinhold, in accordance with Braid's terminology, denote the *pretended* "magnetic state" as the "hypnotic condition."

A.

Symptoms of the Hypnotic State.

I. *Condition of the Sensorium—Imitation Movements.*

One of the most striking symptoms of the hypnotic state is a more or less marked diminution of consciousness.

In the slighter forms of hypnotism, the media are well able to remember what has occurred during their apparent sleep. In this case, however,

* Most of my experience is derived from experiments on the following persons:—Dr. Partsch, Assistant at the Surgical Clinique; Dr. Kröner, Assistant at the Gynœcological Clinique; Messrs. Beyer, Drewitz, Aug. Heidenhain, Poper Wallentin, students of medicine; the wife of the laboratory servant.

some of the phenomena of hypnotism are always wanting.

In the more fully developed forms, the person, on awaking, has no remembrance of what has occurred; but, by giving hints and leading questions of his various actions, he is able to call them to mind.

In the most complete forms of hypnotism, no remembrance whatever is retained.

It can nevertheless be proved that, even during the most completely developed hypnosis, sensory perceptions take place; but they are no longer converted into conscious ideas, and consequently are not retained by the memory.

The reason of this depends undoubtedly upon the fact that the hypnotized individuals have lost the power of directing their attention to their sensations. We are taught by thousandfold experience in our every-day life that sensations only incompletely pass the threshold of consciousness when our attention is not directed to them.

When I sit at my work-table I do not take in the meaning of the words that are spoken near me. Although I really hear them, I form no definite idea of their meaning.

That, under these conditions, sensation does really take place is proved by the fact that we can afterwards, by reflection, call to mind what has been said, presupposing no great interval has elapsed since the impression on the sense organ occurred.

Similarly, a person deep in thought hears a

clock strike, yet does not know the number of beats till, by subsequent reflection, he calls to mind the number.

During free cerebral activity we are extremely liable to pay no attention to what we hear or see.

On the other hand, the power we possess of continuously concentrating our attention in definite directions is so great that it continues even in sleep.

How many a mother who, soundly sleeping, is undisturbed by the loudest noise, yet awakes at the slightest cry of her child! There is, too, the well-known example of the miller waking as soon as his mill ceases to clatter.

The immediate impression on the senses and the conscious perception of this impression are, therefore, two different, separable psychological processes, of which the latter presupposes concentration of the attention.

If hypnotized people lose the power of directing their attention, they must necessarily also lose the power of forming conscious ideas of their sensations.

In order to prove that hypnotized people are still capable of sensory perceptions,* I must first shortly enter upon the question of the genesis of voluntary movement.

Take, for instance, the case of a child learning the piano. Before it is able to carry out with its hands the correct and necessary movements, a complicated but connected series of psychological processes has to be gone through.

* See note on p. 10.

First, it has to form a clear idea of the signification of the note it sees, the note being the visual symbol of a definite musical tone and its corresponding key. The child then has already in its mind a mental picture—we may call it a "sound picture"—of the note.

Secondly, it reflects what movements are required in order to strike the right keys.

As the result of this reflection, a mental picture, which we will call the "movement picture," is formed of the intended movement.

When this point is reached, the will gives the muscles the impulse to carry out the movement.

All these are fully conscious processes, and are accompanied by constant concentration of the attention.

The perception of the retinal image of the note, the "sound picture," the visual image of the keys, "the movement picture," and lastly, the carrying out of the latter, form a series of most intimately connected processes.*

But the case of a practised pianist is different. The oft-repeated chain of psychological processes is shortened; certain links are missing or im-

* My attention is called by musical friends to the fact that, in learning the piano, the child is only taught the correspondence between the notes and the keys. I was taught differently when young. The above view would, moreover, be only so far changed, that the sound picture, as middle term between the visual picture of the notes and the keys, would be wanting.

perfectly formed in consciousness. The perception of the note excites immediately the movement, hence the sound picture and the movement picture are no longer distinctly formed. The observed notes can be "mechanically" played whilst the attention is directed elsewhere.

Thus very frequently, sensory perceptions, which have not clearly become conscious perceptions, are the cause of indefinitely conscious movements.

A man, walking down the street deep in thought, perceives the passers-by, but, owing to inattention, does not recognize them. He, however, manages effectually to get out of their way.

The retinal pictures he obtains of the passers-by, are of themselves the cause of initiation of movements resembling in all respects voluntary movements.

Hypnotized persons are, at a certain stage of hypnosis, in a similar though not exactly identical condition. Unconscious * sensations cause them, too, to carry out unconscious though conscious-like

* In the sequel, the terms "unconscious feeling," "unconscious perception," are used in regard to hypnotized individuals. I am well aware that, literally, these expressions are self-contradictory; for perception and feeling are necessarily conscious.

But there is no other expression which I can use to briefly state what I mean.

Hence, in the sequel, by the terms unconscious feelings, unconscious perceptions, I mean those material changes in the apparatus of the central nervous system, called forth by impressions on the sense organs, which would, were consciousness present call forth the respective feelings and perceptions.

acts, especially such movements of the experimenter as produce in them auditory or visual impressions.

Movements carried out before a hypnotized person, who apparently has his eyes shut, are nevertheless perceived by the eye. The closure of the lids is, in fact, not complete.

The perceived, but not consciously perceived, movement is imitated.

The same with many movements which are accompanied by a familiar and distinctly audible sound.

I clench my fist before Mr. H——, who stands hypnotized before me; he clenches his.

I open my mouth; he does the same.

Now I close my fist behind his back or over his bent head; he makes no movement.

I shut my mouth, still over his bent head, rapidly, so that the teeth knock together; he repeats the manœuvre.

I noiselessly contort my visage; he remains quiet.

A hypnotized person behaves, therefore, like an imitating automaton, who repeats all those of my movements which are for him linked with an unconscious optic or acoustic impression.

The material change, brought about in the central organs through the stimulation of the organs of sense, liberates movements which have the type of voluntary movements, but are not really so.

Thus I can easily induce him to follow me, by walking before him with an audible step; to bend

first this way, then that, by standing before him, and myself performing these movements.

In walking, the medium imitates exactly the time and force of my audible steps.

I may ask you to bear in mind that in our daily life imitation movements also occur.

It is said "yawning" is catching. Children have a passion for imitation.

The psychological condition of hypnotized persons just described, is in the highest degree interesting and remarkable. The movements are called forth by unperceived impressions on the sense organs.

These must, however, be such that they are closely connected with the movement which is to be carried out.

Now, evidently no impression can be more nearly connected with any movement, than the perception of this movement itself, or the sensory perception of some process which is constantly connected with it, *e.g.* the noise which always accompanies the act of swallowing.

Whilst, in the normal state, the conscious idea of a movement gives rise to that movement, in this case it is the *unconscious* perception of it which calls it forth.

I have never succeeded in inducing a deeply hypnotized person to imitate sneezing or coughing, by performing these actions in his presence.

In sneezing, he at most imitates the slight backward and forward movement of the head, which usually accompanies this action.

Still less are laughing or singing imitated in the deeply hypnotic condition, although the facial contortions accompanying the former are sometimes repeated.*

Our movements are linked with yet another class of sensations, besides those above treated of—those sensations, namely, which are connected with the carrying out of the movement in the moved part itself.

When I bend or raise my arm, I become conscious that the limb is in an active condition, and also of the position it is in. I obtain this knowledge by means of the sensory nerves of my muscle and skin, which report as to the degree of muscular contraction and skin tension respectively.

My sensory nerves give me similar information as to the changed position and motion of the limb when it is passively moved by another person.

The intimate connection between the movements themselves and the sensations accompanying them, readily explains the fact that when, in a hypnotized individual, the latter are excited, the former are called forth.

A passive movement which I communicate to a hypnotized person is as a rule continued by him.

When a hypnotized person does not follow

* See Part II.

me on my walking before him with loud tread, I pull him by the hand a few steps forward—it is usually sufficient to lightly pull with the finger—and he then readily follows me of his own accord, if I continue to tramp before him.

This peculiarity which a hypnotized person possesses of performing movements so soon as he obtains an unconscious perception, associated in some way with such movements, explains in part the secret, by virtue of which the experimenter apparently completely subjects his medium to his will.

In a loud voice he commands the medium to do a certain action; the latter has not the least idea of the order given.* The experimenter himself, at the same time that he gives the order, performs the action himself in such a way that the medium must obtain a sensory impression of it. The sensory impression leads to no conscious perception and no voluntary movement, but suffices to set up unconscious imitation.

Mr. Hansen, for instance, puts a raw potato in the medium's mouth; and, calling it a delicious pear, invites him to eat; accompanying, however, this request, as eye-witnesses have informed me, by audible movements of mastication. The medium chews away, purely mechanically, without the least idea of the request, or whether he is eating a potato or a pear.

* See below and Part II.

I could put hot pickles into the mouth of a hypnotized person, and on my making masticatory movements, he would proceed to chew it. Only on awaking would he perceive the hot taste.

In other cases, the adoption of passive movement is more effective; very slight force being usually sufficient, the medium being set going by very gentle taps.

How much does a hypnotized individual know of what has occurred whilst his peculiar condition lasts? This question is exceedingly interesting and important with regard to the proceedings you have just witnessed.

In the endeavour to obtain information about this, we must set to work very cautiously, so as not, by our questions, to give any hints to the person, which would enable him to answer correctly.

If I ask the medium, on his awaking, whether he remembers doing this or that action, he almost always answers in the affirmative. But if I ask him what has occurred during his sleep, the answer is nearly always, "I don't know." On my giving him, however, a slight hint of what has occurred, then he suddenly remembers it.

The hypnotized person behaves like one who, in natural sleep, has been dreaming.

How often does it happen, that the dream, forgotten early in the morning, during the course of the day comes again vividly to our mind when something occurs which has a connection with the

dream, *e.g.* when we meet people about whom we have dreamt! *

* An experiment which belongs here was made during the lecture on Mr. Wallenstein.

He stood, hypnotized, before me, with head thrown back and upward gaze.

I drank audibly some water; he made swallowing movements. I slowly raised my arms. So long as they were out of his field of vision, he remained quiet; but when they came within that area, he followed the movements of my arms with similar movements, and lowered them again afterwards as I did.

When he awoke, he was asked what had happened; and he said, "I don't know."

"You have forgotten?" "Perhaps on account of the heat?" "Are you thirsty?" were my questions.

"Now it occurs to me. I have swallowed something."

When led to think of movements of the arms, he remembered exactly the elevation and depression his arms had made.

On account of the difficulty to make certain how much of the sensory impressions during the hypnotic state are really perceived, I made a series of experiments with my brother, A. Heidenhain, in this way: During the hypnosis, I shouted certain sentences into his ear, and then established how much he remembered, or could be induced to remember, when he awoke.

He generally was able to say whether I had spoken gently or loudly.

But he never remembered, without aid, the contents of the sentences; but by means of leading words he was able to call them to mind.

Some examples may here be of interest.

1. I cried, "Alles schweige jeder neige ernsten Tönen nun sein Ohr." At first, futile endeavours to recollect. When I said the word "schweige," complete recollection and reproduction.

2. Αὐταρ ἐπεὶ πόσιος καὶ ἐδητυος ἐξ ἔρον ἔντο. Leading words, "Homer," "meal;" correct repetition.

3. Ποῖόν σε ἔπος φύγεν ἕρχος ὀδόντων. Leading word, "entflon;" correct, but very hesitating repetition.

4. "Roth lack—Grün lack—Gold lack." Leading word, "lack;" immediately remembered "Gold lack," and when a red and a

In order to translate what I have stated to you into the terminology of modern psycho-physics, permit me to define to you the expression, "Liminal intensity of stimulation" (*Reiz-Schwelle*).

For every sensation there exists a certain minimal strength of stimulation, which must not be diminished, or no sensation at all will be produced.

If the quantity of light which falls on the retina be too small, if the intensity of a sound which meets the ear be too weak, then no sensation of sound or of light arises. The smallest strength of stimula-

green book were seen, "Grün lack" and "Roth lack" also remembered.

My brother always said that he had great difficulty in deciding whether he had really remembered what had been heard, or whether he only guessed it as a result of the hints given. In order to avoid all doubt, I tried to lead him on the wrong track.

Before us stood two empty beer-bottles. I sent for a third, and in the mean time, having quickly and deeply hypnotized my brother, said in his ear, "Wohlauf noch getrunken den funkelnden Wein." At first, no remembrance. Leading word, "getrunken;" immediate reproduction of the verse, although I had remarked immediately before the hypnosis that the beer was "ausgetrunken," and thus had purposely used the word "getrunken" to bring up other associations. At last, I made another experiment. Instead of saying anything, I laughed loudly. On awaking, I gave him the word "laugh" as a hint. Answer, "You have said nothing, but laughed."

I do not know any other explanation for these facts than this. The sensory impression leaves behind in the perceptive ganglion-cells of the first order, material changes, which are not propagated during the hypnosis to the sensorial cells of the cortex of brain. These changes in the former region are, after the awaking, so increased by every small stimulus, that they now pass to the liberated sensorial ganglion-cells and set them in activity.

tion which just produces sensation is called, after Fechner, the liminal value of stimulation.

Now, the hypnotized person is distinguished from the normal in that, for him, the liminal value of stimulation is extraordinarily high; sensory impressions which produce in a normal waking individual vivid sensations, and hence conscious perceptions, are unable in a hypnotized person to pass the threshold of consciousness.

Nevertheless, they are in this case none the less active. For the picture imprinted on the ganglion-cells by the unconsciously perceived movement, acts as a stimulus upon the motor apparatus of the brain, and liberates a similar movement, and the unconscious perceptions leave behind them traces of which he is not conscious, but which occur to his memory when similar external stimuli again force an entrance.

You thus see, gentlemen, that the hypnotic state, as it has been shown to us by Mr. Hansen, when we take away all theatrical by-play, contains a number of facts highly interesting to the physiologist and psychologist, which have hitherto excited remarkably less attention in physiologists than they deserve.

I must add that what I have above stated only holds good for a certain depth of the hypnotic state.

In slighter degrees, which are, however, interest-

ing in other respects (for they show all the phenomena in the muscles to which I shall more fully refer), the sensorium is so far unaffected that the medium is fairly conscious of all that has occurred. Imitation movements are not compulsory for such persons; so long, therefore, as consciousness is clear, the motor apparatus is not directly excited through sensory impressions. With the disappearance of consciousness movements become compulsory.

There appears, however, to be a very high degree of hypnosis, in which every trace of sensory perception, and consequently, of imitation movements, is absent.

I have had one such case in the person of the wife of the laboratory servant.

Dr. Born, Prosector in the Anatomical Institute, has seen several such cases, also in women—a question which must be further investigated.

II. *Analgesia.*

A further symptom of the hypnotic state in its most complete development is highly marked insensibility to pain.

The fact that sensations of pain and tactile sensation travel through different nervous paths, has long been an established fact in physiology and pathology.

Diseases of the nervous system have long been known in which the tactile sensation is so com-

pletely maintained that gentle stroking with a camel's-hair brush is felt, and the point of application of the latter exactly stated by the patient, whilst deep pricks with a needle, cauterization, and the like, do not cause him the least pain.

Such a state of analgesia can readily be produced artificially by means of chloroform inhalation.

At a certain stage of the narcosis, the patient feels the contact of the instrument which the operator uses, but not the pain of the operation.

In a hypnotized person a pin may be run right into the hand, and only an indistinct feeling of contact is brought about.

Immediately on awaking, the full sense of pain is again present, and pulling out the pin causes acute pain.

III. *Increased Reflex Irritability and Tonic Spasm of the Voluntary Muscles.*

Another most interesting point is the increased reflex irritability of all striated muscles, which accompanies the hypnotic condition.

In order to clearly understand this important fact, the non-medical part of my audience require a definition of so-called reflex movements.

This kind of movement is thus produced.

Sensory nerves are irritated at their peripheral ends; they transmit the state of irritation to the central organs of the nervous system, and, through

the agency of nerve-cells, without any influence on the part of the will, transmit it to motor nerves.

The motor nerve, for its part, conducts the state of irritation again peripherally towards the muscles it supplies, and sets them in activity.

For instance, when a grain of sand flies into the eye, the lids instantly close.

The foreign body irritates the sensory fibres of the fifth cerebral nerve, which are distributed over the surface of the eyeball. In the brain, the state of irritation is transmitted to the facial nerve, by means of which the muscle closing the eye is set in activity.

Or, I "choke," that is, a fragment of food gets into the larynx. Sensory fibres of the vagus nerve are irritated reflexly; a cough, *i.e.* a sudden contraction of the expiratory muscles, is produced.

I have just said that the reflex movement takes place independently of the will.

Now, we can certainly close our eye, and cough, voluntarily. Where, then, is the proof that reflex actions are independent of the will?

First—In the fact that, muscles can (reflexly) be made to contract which cannot by any force of the will be made to contract. When light falls on the retina, the pupil contracts; by means of muscular action, no one can voluntarily contract the pupil.

Second—Reflex movements, when the stimulus is strong enough, occur in direct opposition to the

will. After a pinch of snuff, the sneeze can be for a certain time suppressed, but if the action on the nasal mucous membrane has been strong enough, not permanently suppressed.

The last illustration leads us to an important fact. Reflex movements can be rendered difficult, or inhibited, through the influence of cerebral activity.

In fact, it has long been known to physiologists that when certain parts of the brain are extirpated (*optic lobes*, *medulla oblongata*), the reflex irritability is in a high degree increased.

Now, in the case of hypnotized individuals, the depression of the activity of certain parts of the brain is beyond all question. The increase in reflex irritability observed in them is, therefore, no new physiological experience. The unexpected part of the matter is the fact that this increase of reflex irritability, in persons who have awakened from a deep hypnotic condition, in spite of their return in all other respects to a completely normal condition, continues for a long time—days, and probably weeks.

I gently stroke once or twice along Dr. Kröner's flexed right arm, which at once becomes stiff, since all the muscles are thrown into a condition of reflex spasm.

Dr. Kröner has, however, not been hypnotized for several days.

I should further call your attention to certain

laws, in obedience to which the reflex muscular contraction spreads over the body, when certain definite cutaneous surfaces are irritated. The course of events varies somewhat with the degree of increase of reflex irritability, and this is always heightened by repeating the hypnotism in the same individual.

With slight increase of reflex irritability, those muscles alone contract which lie immediately under the area of skin which has been stroked.

In this condition it is easy to bring single muscles and groups of muscles into isolated action, and thus demonstrate their special motor function.

Stroking the ball of the thumb causes adduction (towards the palm) of the thumb.

Stimulating the skin over the sterno-mastoid causes the head to assume the well-known oblique position which it has when one has got a "stiff neck."

Stroking the skin at one corner of the mouth leads to distortion of the mouth on that side, owing to the contraction of the muscles inserted there.

When the irritability is somewhat more increased, we are able, by continuous irritation of a definite spot of skin, to set in activity neighbouring and distant groups of muscle, according to the degree of irritation.

Thus, when I gently stroke the ball of the thumb, only the flexors and the adductors of this member

are set in activity. If I stroke somewhat harder, the forearm muscles, especially the flexors of the fingers, contract. Our patient can, however, still bend and stretch his arm at the elbow, the upper arm muscles being still unaffected. Through further increase of the irritation, the latter too and the shoulder muscles are thrown into spasm, so that the whole limb appears immovably fixed.

But the highest degree of reflex irritability is not yet attained.

Mr. A. Heidenhain sits quietly here on a chair. I now once stroke the ball of his left thumb. Please observe the exact succession in which the spasm slowly spreads from one part of the body to the others. You will see the following muscle groups are successively affected, some seconds intervening in the passage from one group to another.

Left thumb,	Right hand,
„ hand,	Left leg,
„ forearm,	„ thigh,
„ upper arm and shoulder,	Right thigh,
Right shoulder and arm,	„ leg,
„ forearm,	Muscles of mastication,
	Muscles of the neck.

But now I must put an end to it. I strike forcibly on the left arm, and the rigor at once disappears. Instant relaxation of the whole body occurs also when I forcibly extend a finger of

the clenched fist. Probably the reflex excitement would extend still further, but I naturally consider it impossible to try whether the muscles of respiration would become affected.

It is easily understood that such experiments require the greatest caution, and can only be very seldom carried out.

By the aid of previous notes, I can complete the series of observations just made.

With cutaneous irritation of the right leg, the rigor spreads up the right lower extremity, then down the left leg. Then the upper limbs are affected—first the right, from below upwards; then the left, from above downwards. And lastly, again the muscles of mastication and the cervical muscles.

Under normal conditions, a reflex stimulus excites a quick and transitory contraction. A wink or a cough are actions which rapidly pass by.

In hypnotized persons the muscles reflexly excited by gentle stroking of the skin remain contracted for a long period. They fall into a condition of so-called tetanic contraction, and hence the parts of the body they belong to become stiff, or rigid.

By this long-continued muscular contraction, hypnotized people remind us of persons affected with a disease called catalepsy, in which a similar behaviour of the muscles is observed.

This disease of the nervous system has long

been known to medical men, but it is very rare, and has consequently been little studied.

I have never seen it myself, but so far as I am acquainted with it from the experience of others, I am inclined to consider that *the hypnotic state is nothing more than an artificially produced catalepsy.*

The possibility of fixing any part of the body in any given position, constitutes an essential factor in the manœuvres adopted by Hansen in his performances.

In fact, granted we possess the means, firstly, as above stated, of causing the medium to carry out any given movement; secondly, of fixing any part of the body in any given position,—then we can do just what we please.

Mr. Hansen puts X—— into a state of unconsciousness, makes him stand up, and brings his arms into the position nurses adopt when they are carrying a child at full length. When the arms are in this position, he induces muscular rigidity in the arms by gently stroking them; so that the arms continuously maintain their position.

Now Hansen induces the medium to rock from side to side, either by himself performing this movement in front of the medium, or by gently pushing him, so as to initiate the movement.

Now, suppose, in addition, a doll has been placed in X——'s arms, and you have the "nurse and child,"

the spectacle about which we have heard so much in the newspapers. There is no premeditated deception.

The only false conclusion to which the spectators are led, is that they acquire the notion that the medium thinks and knows himself to be at that moment in the situation *they* have in their minds.

This is quite out of the question. The hypnotized individual neither thinks nor knows anything about himself.

In powerful persons, the immovability of the body, caused by the rigor of the muscles, becomes so exceedingly great, that it is almost impossible to alter the relative position of the different parts of the body.

Such persons become as stiff as a board.

You may confidently, as Mr. Hansen does, sit on their body, when the latter is horizontally placed, and only supported by its two ends, without its giving way.

In order to give you a striking illustration of what has just been said, allow me to make an experiment.

I make this gentleman, Mr. Poper, sit before me on this chair, and I so adapt his hands to the seat, that his fingers grasp the edges.

After hypnotizing him, I stroke along his arms, and his fingers take convulsive hold of the edges of the seat.

Now placing myself in front of him, I bend forward; he does the same.

I then walk noisily backwards, and thereupon Mr. Poper follows me through the hall, carrying his chair with him, like a snail carrying its shell.

You see into what absurd situations and proceedings we can force hypnotized individuals by means of the above-mentioned aids.

I cannot conclude this division of my subject without emphatically pointing out that the results I have obtained concerning the great increase of reflex irritability in hypnotized people, show that the greatest caution is necessary in such experiments.

How long this increase lasts, I am not able to say, since my experience on the subject is too small. As far as I have seen, it diminishes after a few days, and I should conclude, from Weinhold's statements, that it disappears altogether in a few weeks.

At all events, I must strongly warn against the repeated subjection of the same person to hypnotic experiments for a length of time.

I have myself been very cautious in this respect, for the unquestionably abnormal state might finally, through long habituation, become a permanent one.*

* In the interest of the further investigation of the hypnotic state, the abstention, which is absolutely necessary, is to be regretted.

Still, I believe that experiments with animals will help us out of the difficulty.

For the phenomena, described some years ago by Czermak as

IV. *On some Further Phenomena during the Hypnotic Condition.*

As yet I have only described and experimentally demonstrated those changes in the motor and sensory apparatus which Mr. Hansen applies with so much skill in his representations.

There are, however, other important phenomena to be observed in various organs which physiologically are no less worthy of attention.

The very first demonstrable symptom of the commencement of the hypnotic state is a spasm of the accommodation apparatus in the eye.

It is observable at a period when the medium * has scarcely begun to feel the subjective sensations which denote the approach of the hypnotic sleep.

The result of it is the diminution of the limits of accommodation, in consequence of the "far point" approaching the "near point."

Writing that previously could be read at greater distance, can now only be made out when quite close.

hypnotism in animals, and which Preyer further investigated under the name of cataplexy, appear to me to have the greatest resemblance with the hypnotic condition in men. Since the above lecture was given, it has been found that the unpleasant reflex irritability of the muscles greatly diminishes, and finally altogether disappears, if no experiments are made on the person for some time.

* The word "medium" is often used in the translation instead of the long phrases, "person experimented on," "hypnotized individual" (*versuchs person, hypnotisirte*).

Distant objects seem to swim before the eyes—a fact which possibly helps to induce in the medium a certain degree of confusion and mental excitement.

After some time, if the hypnotizing is proceeded with, other eye symptoms almost constantly appear. The pupils enlarge, to a different extent in different people; the eyes open more widely than naturally; the eyeballs protrude.

This complex of symptoms points with certainty to an irritation of certain fibres of the cervical sympathetic, by which the dilator muscle of the pupil and the orbital * muscle are made to contract. The sympathetic fibres in question have their origin, however, in the medulla oblongata. The irritation, therefore, must start from this point.

But other parts of the medulla are also stimulated, as is shown by the almost constant increase of the rapidity of breathing, due to stimulation of the respiratory centre. This increase may be very considerable. I have seen the number of respirations, in fifteen seconds, rise from four to twelve, or even from three to sixteen. The pulse quickens in less degree, but still distinctly, perhaps only as a consequence of the quickened respiration.

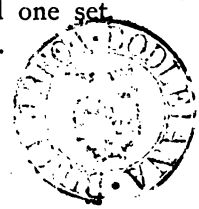
Again, as a rule, in deep hypnotism, especially when it has been repeatedly induced, there is very profuse perspiration—a sign of irritation of the

* In many animals this muscle clothes the circumference of the orbit like a flat carpet. In man it is less developed.

nerves of the sweat glands. Often, too, there is an apparent increased flow of saliva; but I am not quite certain on this point.

I must leave the question undecided whether hallucinations * occur during the hypnosis. I have not yet observed them. Mr. Hansen himself told Dr. Grützner that he had not succeeded, in Breslau, in inducing hallucination. Dr. Grützner, on the other hand, tells me that he is informed by a gentleman whom he has hypnotized, that at the commencement of the hypnosis a strong smell of violets was perceptible.

The picture I have drawn of the condition of hypnotized people is certainly still very incomplete, and must in the future undergo numerous corrections and extensions. The main features appear again and again; but in one individual one set, in another another set, is more prominent.



B.

CONDITIONS NECESSARY TO THE INDUCTION OF THE HYPNOTIC STATE.

Whilst I now turn to the conditions determining the establishment of hypnotism, I must, before all things, especially emphasize the fact that there

* See Part II.

is no question of any specific force exerted by the experimenter upon the passive subject.

I am quite ready to suppose Mr. Hansen believes in his possession of such a power. But for physiologists this is out of the question. All the phenomena I am at present acquainted with are explicable from simple premises which have a perfectly sound physiological basis.

It is undoubtedly perfectly true that hypnotic experiments do not succeed with every one upon whom they are tried; in fact, the operator is rewarded with success only in a very small percentage of the total number of persons experimented on.

So far as I can see, the "susceptibility" depends on the existence of a greater or less degree of sensory irritability; consequently, pale, anæmic individuals are most liable to hypnosis.

Mr. Hansen states, as the result of his experience, that active, muscular individuals are especially adapted for his experiments, and he hence prefers English students, who row, swim, and ride, to German students, with their prolonged sedentary mental work.

From what I have observed, I think that, in this preference, Mr. Hansen takes especially into consideration the intensity of the muscular rigor, which would of course be more marked in his favourite subjects than in less robust persons.

But I have every reason for doubting that the percentage of successful cases is greater in the former than in the latter class of persons.

Many people possess originally the sensory irritability; in others it can be artificially induced.

So far as I can see, the sole object in the preliminary staring at the glass button * is to increase the sensory irritability. Mr. Hansen regards it as a means of quieting; I look on it as a means of exciting.

Some people are incapable of being hypnotized without this previous fixed gazing at some glittering object.

In other instances, this is not necessary but only advantageous, since it renders the establishment of hypnosis easier, and produces better-marked results.

How does this glass button act?

Any one who tries the experiment of fixedly staring at the glittering object for a long time, notices that peculiar visual phenomena appear.

Apart from the natural dazzling, which makes tears flow pretty freely, images occupying the lateral parts of the field of vision very soon vanish,

* Mr. Braid, of Manchester, first showed that uninterrupted staring at inanimate objects brings about a sleep-like condition.

According to his experience, many persons are thereby thrown into catalepsy, and become insensitive to pricks of a needle; some are conscious; some, on awaking, know absolutely nothing of what has happened to them.

According to a communication from Mr. Rossi (physician to Halein, Viceroy of Egypt) to MM. Giraud-Teulon and Demarquay, Egyptian conjurors have hypnotized for many centuries, by making their media stare at cabalistic marks on glistening porcelain plates or at a glittering crystal ball.

owing to the rapid exhaustion of the peripheral parts of the retina.

The hand holding the button becomes indistinct, and the button itself seems to swim before the eyes.

Then follow phenomena of contrast, and, as the result of slight involuntary movements of the eye, after images.

Thus the whole field of vision is thrown into an unsteady condition.

Any one who does not know what this optical unsteadiness means, is put thereby into an excited and irritable state, which is still further increased through the expectation that something unknown and unusual is about to take place.

When I speak of increased irritability of the sensory apparatus, I mean not merely the sensory nerves themselves, but also their central ganglion-cells in the cerebral cortex, which bring about the consciousness of the sensation; in fact, all those parts of the brain which act as the sensorium.

A certain degree of psychical excitement appears to favour the establishment of the hypnotic condition in an extraordinary degree. I take it that the reason why so many people here in Breslau can be hypnotized, is due to the excited state in which the public has been thrown by the astonishing exhibitions of Mr. Hansen.

Where the possibility of such excitement is absent, as in the case of children, hypnotizing experiments scarcely ever succeed.

Lunatics also appear, according to Dr. Jänicke's statements, to be unaffected.

But I must, on the other hand, insist on the fact that adult people, who have heard nothing about it, and who do not know for what purpose they are being experimented on, can be hypnotized.

When this ill-defined state of irritability is once present, either naturally, or artificially induced by means of the glass button, the manipulations of the experimenter commence.

The mystical view regards the operator as the possessor of a special power, by means of which he can voluntarily act on the person experimented on. Fortunately, I am able to turn even its strongest adherents from this belief.

With a very high degree of irritability, such as is met with after previous hypnosis, the hypnotic condition can be brought about without the instrumentality of a living being, simply by certain definite physical stimuli.

Weinhold has already noticed that certain sounds have a hypnotizing influence upon excitable subjects. You can yourselves immediately confirm this observation.

I place three students on chairs, the backs of which rest against a table, and I lay a watch upon the table; but for this purpose I will ask one of the audience to lend me his watch, for the "mysticist" might make the objection that my watch had some sort of "magnetism" about it.

Now, the three gentlemen must listen to the ticking of the watch.

In two minutes, two of them are so deeply hypnotized, that they make imitation movements, and in a sleeping state follow me about the room. The third appears less affected, but when I blow on him he starts up, and looks around surprised, as the media always do when they awake.

There is then no doubt that, under favourable conditions, the hypnotic state can be established without the aid of a "magnetic" individual.

All other slight and monotonously repeated sounds act similarly to the ticking of a watch.

They are particularly effective, as Mr. Weinhold tells me, when the eyes are closed.

I have been able to produce hypnosis by long-continued clicking with the finger-nails; by singing the well-known nurse's melody, "Hush—sh—sh!"

Gentle and rhythmical stimulation of the skin acts in the same way as acoustic stimulation.

The manipulation of making passes—*i.e.* of slowly moving the hands, close to the medium's face, from forehead to chin, and here and there actually touching the face—owes its effectiveness to this cutaneous stimulation.

With the stroking *par distance*, every one, even those with no disposition for hypnotism, experience peculiar sensations.

These are partly tactile, partly heat sensations: tactile sensations, because a slight draught of air

is set up, which produces a creeping or tickling feeling; sensations of temperature, because the hands and the face they approach are usually not of the same temperature. Every difference of temperature of one part is perceptible to the other.

The physiological cause of the hypnosis is to be found in the rhythmical application of such gentle stimulation.

Mr. Hansen thinks that only certain persons possess the power of magnetizing.

It is true, that, with only slightly excitable subjects, one person's hand is more efficacious than another's; many hands are quite ineffective.

The reason for this elective behaviour is evidently to be found in the fact that the physical condition of different hands, their temperature, moisture, etc., and their style of movement, are different.

So that the conditions favourable to gentle cutaneous stimulation do not always exist.

Mr. Hansen, when carrying out his stroking manipulations, evidently works with great muscular effort.

He flexes and extends his hands with great force; consequently, his hands become very moist and warm, as I noticed when I subjected myself to his manipulations.

Hence the skin of his hands is in a physical condition as different as possible from what the skin of the medium's face is—a state of things favourable to stimulation.

If, to begin with, the excitability is great, which is always the case in people who have been frequently hypnotized, fewer favourable conditions are requisite for the necessary cutaneous stimulation.

Such subjects can be thrown into the cataleptic state by any one.

This explains why, at first, I could only hypnotize my brother with uncovered hands, whilst later on I could do so, even with thick gloves on.

In addition to stimuli which act on the skin and ear, stimuli acting on the eye are also efficacious; but, as a rule, only after acquired increase of irritability.

The medium falls asleep, after staring at the operator for some time.

When the irritability has reached a very high pitch, any one can take the place of the operator. Even staring at lifeless objects has often the desired effect.

Thus all stimulations which are effective, have the common character of being weak, continued, and monotonous.

Different people react differently to the various kinds of stimulation. Some more readily with cutaneous, others with retinal or aural stimulation.

Dr. Kröner can only be sent into the sleep by cutaneous irritation, and then only when his eyes are closed.

Mr. Poper becomes most quickly hypnotized by staring at me.

If I blindfold him, and then proceed to stimulate the face, the hypnosis is much less readily established, and is also much less pronounced.

The same sense organs, gentle stimulation of which lulls consciousness to sleep, awake it when they are more strongly acted upon.

Sudden blowing upon the face, a knock on the hand, a cry in the ear, and the charm is broken.

Cold rapidly produces awaking.

Touching the face with cold fingers generally suffices to terminate the hypnosis; hence the difficulty of hypnotizing with cold hands.

Every touch makes the medium start.

When bright light falls on the eye, as during ophthalmoscopic examination, the hypnotized person becomes evidently disquieted; the eye moves from side to side, and the hypnosis soon vanishes.

Another interesting observation is that a person, thrown into hypnosis by staring at the operator, frequently awakes when a third person takes his place.

Mysticism will see in this a support of the view that the magician exerts a secret power over the enchanted one.

It is, however, nothing more than the sudden change of the retinal picture, which here acts as the awaking stimulus.

Mr. X——, who is very sensitive, but who could at first be only sent into the sleep by myself, so

that I, in the sense of the mysticist, evidently exerted the greatest power over him, reacted later, when his susceptibility was still further increased, to the look of any one else.

Now, if Mr. X—— has been hypnotized by a third person, and during the hypnosis I take the place of the latter, immediate awakening is the result; notwithstanding the fact that my magnetic power is evidently greater than his whose place I took.

From all that has been said, we may assert that in irritable persons hypnosis is induced by means of weak, long-continued, uniform stimulation of the nerves of touch, sight, and hearing; whilst it is removed by strong or suddenly varying stimulation of the same nerves.

I repeat that the condition of psychical excitement greatly promotes the effectiveness of the stimulation used to induce the sleep. And it has, moreover, seemed to me as if the expectancy of the approach of the sleep in some cases produces such psychical excitement that it really occurs.

C.

On the Nature of the Hypnotic Condition.

The answer to that most interesting question—On what does the hypnotic condition depend?—leads us partly into the region of hypothesis.

It is the fate of every investigation in natural science that, after the establishment of a series of connected facts, which can be objectively observed, an hypothesis must be established which brings these facts into causal connection with one another.

In order in this case to attain to such an hypothesis, I will first bring forward the scarcely disputable statement that hypnotism depends on a changed condition of the central organs of the nervous system, the brain and spinal cord.

By reference to experience gained from experiments on animals and pathological observations on men, we can, to a certain extent, particularize this general statement.

We know that the functions of consciousness depend on the integrity of the grey cortex of the cerebrum.

Since now, in the case of a hypnotized person, consciousness is greatly diminished, it is a self-evident and undoubted fact that the cerebral cortex is functionally affected.

But how far does this functional disturbance extend to the deeper parts of his brain? The following can be said with certainty :—

The activity of the corpora quadrigemina is not lessened; for the pupil of a hypnotized person contracts energetically when light falls upon the eye.

This reflex movement, which is initiated by stimulation of the retina, and carried out through

the agency of the third cranial nerve, no longer takes place (as is shown experimentally in animals) when the corpora quadrigemina are rendered functionless.

The fact that hypnotized persons never fall down, speaks also in favour of the integrity of this part of the brain.*

When placed in the most complicated positions, they still maintain their equilibrium.

As soon as the centre of gravity is unsupported, they make a step, by which they recover the lost support. Now, we know from Professor Goltz's admirable researches, that the centre for equilibration, that is, that part of the central organ which co-ordinates the movements necessary for maintaining equilibrium, is situated in the corpora quadrigemina.

A frog, whose cerebral hemispheres have been removed, can still crawl up a board held obliquely, and, by appropriate movements of its arms and legs, can balance itself on the edge of the board. But when the corpora quadrigemina † are extirpated this capacity is lost.

Since the power of equilibration is possessed in full degree by hypnotized persons, their corpora quadrigemina must be unaffected. And so, too, are the corpora striata in all probability.

* I have since observed in one person that, in a condition of deepest hypnosis, he was unable to maintain his equilibrium in the upright position. So that the statement in the text is only true for the majority of hypnotized people.

† In the frog, corpora bigemina.

Concerning the other parts of the brain I cannot make such definite assertions. But probably the cerebral cortex is not the sole part whose activity is inhibited.

For otherwise the phenomena hypnotized people present would be a repetition of those observed in animals after removal of the cerebral cortex. And although points of resemblance do certainly exist between the two series of phenomena, they are by no means identical. This is not the place to enter on this subject. But evidently a complete removal, and a simple functional disturbance of the cerebral cortex, do not necessarily produce a like result.

This disturbance of functions explains why hypnotized persons neither acquire any conscious perceptions as the result of sensory impressions, nor spontaneously make voluntary movements. It explains, too, the forced movement which occurs when such sensations and unconscious perceptions as stand in immediate connection with the movement are excited.

For while, under normal circumstances, movements can be not only initiated by the cerebral cortex, but also inhibited, in the hypnotized subject both powers are absent.

Normally, when the idea of a movement presents itself to our consciousness, we can carry that movement into effect or not. In the hypnotic condition, owing to the absence of the inhibitory power of the will, the unconscious perception of the move-

ment irresistibly brings it about—a process in all respects analogous to reflex action.

But what causes this inhibition of the functions of the cerebral cortex?

The first hypothesis that occurred to me was that it might be due to contraction of the arteries supplying the brain, reflexly produced by the sensory stimulation used to induce the hypnotic state, due therefore simply to anæmia affecting definite parts of the brain.

That sudden anæmia of the brain does produce unconsciousness, is a daily experience of the physician. Certain phenomena observed in hypnotized persons appear to render this view of the matter still more probable.

When in an animal the arteries supplying the brain are compressed, symptoms occur in the eyes which remind us of those seen in hypnotized persons.

After initial contraction of the pupil, follows dilatation; after initial slight closure of lids, wider opening of the same; after sinking in, projection of the eyeballs.

Now, in deep hypnosis, widely opened eyes with unusual prominence of the eyeballs is an extremely frequent, if not a constant, phenomenon.

Though this hypothesis of partial reflex anæmia thus receives some support, the extension of my experience led me to abandon it.

In the first place, the fact that most hypnotized

persons, instead of becoming pale, are generally very red, was unfavourable to the theory of reflexly contracted arteries.

No less unfavourable was the result of an examination of the retinal vessels, carried out at my request by my colleague, Professor Förster. This was attended with difficulties, partly owing to the strong contraction of the pupils, brought about by the light reflected from the mirror, and partly owing to the fact that the vivid and sudden illumination of the retina brought the hypnosis rapidly to a close. Still, Professor Förster repeatedly succeeded in obtaining a sufficiently distinct view of the central vessels of the retina, and no particular constriction of these vessels could be made out. If reflex contraction of vessels were the cause of the paralysis of the activity of the brain, it would certainly be of so high a degree that it could not fail to be detected in this examination; for it can be scarcely supposed that the vessels of the cerebrum and eyes are in an essentially different condition.

However, there was still room for doubt, and this was decided by an *experimentum crucis.*

It is a well-known fact that inhalation of nitrite of amyl causes considerable dilatation of the arteries. In consequence of this, the face flushes, and a feeling of hammering and strong pulsation is felt in the head.

My brother, Mr. Heidenhain, knew, from previous

experience, the exact subjective symptoms caused by amyl nitrite.

It was, however, frequently possible not only to hypnotize him while the flushing of the face was evident, and the feeling of pulsation in the head was markedly present, but the hypnosis was always of a more marked character than that induced previously to, or after, the amyl nitrite inhalation. I obtained a like result with Dr. Kröner.

Hence my first supposition is wrong; it is impossible that contraction of the cerebral arteries is the cause of the hypnosis.

On more careful consideration, another hypothesis, which receives support in other well-known physiological experiences, appeared to me not improbable.

Nerve fibres are not independent organs; their function depends on the activity of the nerve-cells (ganglion-cells) with which they are connected.

A motor nerve fibre is only stimulated through the medium of the motor nerve-cell with which it is in connection.

And a sensory nerve fibre only produces a perception by setting in activity a ganglion-cell in the brain, by means of which consciousness is so influenced that perception results.

A series of facts, however, are known which teach us that the activity of ganglion-cells can be arrested when certain nerve fibres with which they are connected act upon them.

The heart offers the longest-known example of

this kind. In the substance of this organ ganglion-cells are situated, which, at definite intervals, throw into activity the motor nerve fibres of the heart, and the rhythmical beat of the heart is the result.

However, certain fibres go to the heart from the vagus nerve, which have the power, through their action on the ganglion-cells of the organ, of diminishing, or for a time completely arresting, the action of the heart. Stimulation of these cardiac branches of the vagus causes a slowing, or temporary or complete standstill, of the heart. Hence the vagus is called the "inhibitory" nerve of the heart.

But we have other similar examples. According to Rosenthal's observations, the result of stimulation of the sensory nerve of the larynx is to cause relaxation of the respiratory muscles, and consequently to put an end to breathing. We infer that this nerve inhibits the activity of those cells of the medulla oblongata through the rhythmical activity of which the action of the respiratory muscles is caused.

Lewisson has observed that when an indiarubber band is applied under the lower jaw of a frog, the animal speedily loses the power of voluntary movement. The sensory irritation, through continuous pressure, causes inhibition of the activity of those ganglion-cells by means of which the influence of the will is brought about.

In rabbits, pressure on internal organs, such as

the kidney, bladder, or loops of intestine, produces for the same reason paralysis of the hind legs.

Reflex paralyses, as they are called, have long been known to pathologists.

They occur especially in hysterical women, and depend on the irritation of sensory nerves of certain regions through which the activity of certain motor ganglion-cells is arrested.

I have already mentioned the inhibition of reflex movements by means of the activity of certain parts of the brain. It depends on the fact that the cells through which the reflex action is brought about, are rendered incapable of performing their function, because certain parts of the brain with which they are anatomically connected, are in a state of activity.

These examples suffice to show that the functional activity of motor ganglion-cells can be arrested through the interaction of certain nerves which are in connection with them; and not only the activity of ganglion-cells presiding over reflex and involuntary motion, but also of those which bring about voluntary motion.

Moreover we have lately learnt that the activity of sensory nerve-cells may also, under certain conditions, become inhibited.

In continuation of certain observations first made known in France, Adamkiewicz has found that stimulation of a certain cutaneous area, *e.g.* of the arm, by a mustard poultice, diminishes the sensibility of the corresponding part of the other arm.

This can only be explained by supposing that the ganglion-cells which are in connection with the sensory fibres of the affected part are depressed in their activity by means of the sensory fibres of the irritated part of the skin.

In face of all these facts, it appears to me that the hypothesis *that the cause of the phenomena of hypnotism lies in the inhibition of the activity of the ganglion-cells of the cerebral cortex* is not a too adventurous one ; the inhibition being brought about by gentle prolonged stimulation of the sensory nerves of the face, or of the auditory or optic nerve.

These sensory nerves, when in that state of stimulation which has above been fully described, would behave, in regard to certain psychical cells of the cerebral cortex, like the cardiac branches of the vagus in regard to the ganglion-cells of the heart, or like the fibres of the superior laryngeal nerve towards those cells of the medulla oblongata which preside over respiration, or like those sensory fibres of internal organs which are concerned in Lewisson's experiment and in hysterical paralysis.

I have arrived at the conclusion of my lecture. I hope I have succeeded in convincing you that, in Mr. Hansen's performances, we have not to deal with any unknown specific force, but with the establishment of physiologically definable conditions of the cerebral organs, which are dependent on stimulation of sensory apparatus; and which

can be judged of in the light of the knowledge we at present possess of the functions of the nervous system, without our being obliged to take refuge in any kind of mysticism.

But now allow me an *oratio pro domo.*

Any one who, a hundred and fifty years ago, had publicly exhibited such experiments as Mr. Hansen does daily, and I to-night have done, would have infallibly been proceeded against for witchcraft.

Fifty years ago, such a demonstration would certainly have led to a new kind of superstition, as indeed took place when the excitement about animal magnetism was at its highest.

We owe it to the rapid advance of experimental physiology that we, to-day, can guard ourselves against such a deception.

The discovery of sensory and motor nerves ; the minute investigation of reflex actions ; the recognition of inhibitory processes in the nervous system; the still defective, but fairly established knowledge of the functions of the several great divisions of the brain, have only been rendered possible through experiments on animals.

In my opinion, not only is the healing of bodily diseases, but also the overcoming of mental maladies, an advantage to mankind.

And belief in witchcraft and mysticism are such mental diseases, from which civilized nations can be freed only through increasing knowledge of nature.

Have we not just seen a great number of our fellow-citizens oppressed by the mental burden of feeling that they stood in the presence of something unknown, and apparently inexplicable without supposing the existence of a new, specific, and mysterious force? For it is really perplexing to see the actions of a man apparently immediately subject to the will of another.

This burden is, I hope, removed by the physiological explanations I have given you.

But the possibility of my explanation rested solely upon the extension of physiological knowledge which has been made during this century by means of experiments on animals.

Can it be called reasonable, when an agitation, arising from good principles, but ignorant of the nature and aims of science, seeks to wrest from physiology the most essential aid to its advance—Vivisection?

ADDENDUM.

The above pages contain, as nearly as possible —the alterations being unimportant—my lecture of the 19th of January.

It was not practicable before a mostly non-medical audience to enter upon the numerous questions of cerebral physiology which are connected with the investigation of the hypnotic condition.

To answer them further investigations are necessary, for which I have made arrangements with Dr. Grützner.

At present this much may be said.

The physiology of the present day has adopted more and more fully the view that those movements which are initiated as a consequence of perception, and hence of the ideas called forth by the latter, are brought about through the agency of the cerebral cortex; that, on the other hand, another class of movement does not require the interaction of the cerebral cortex, viz. such which, as a result of continued repetition, can be finally carried out without attention, and without consciousness.

Ferrier, for instance, considers the corpora striata as the centre for the automatic organization of such movements. On the other hand, he regards the thalami as an intermediate ganglion, through which sensory impressions pass on their way to those localized areas of the cerebral cortex which subserve conscious sensation.

In the case of movements consciously carried out as the result of external impressions, the state of excitation passes through the thalami to the cerebral cortex, within this from the sensory to the motor centres, and from the latter downwards through the corpora striata to the crura cerebri.

Whilst in the cerebral cortex, motor centres for the different parts of the body are spread out, as it were, and are set in activity by the will, in the

corpora striata there is an automatic mechanism corresponding to these centres, which becomes perfected through use.

In the case of movements which are unconsciously carried out as the result of sensory impressions, the state of excitation is transmitted from the thalamus direct to the corpora striata, instead of going by way of the cerebral cortex.

Movements accomplished with consciousness are called by Ferrier "noetico-kinetic movements." The movements carried out by means of the short route, and without consciousness, are called by him "hypo-noetico-kinetic."

Without wishing to assert that Ferrier's special localization of the processes in question is correct, I have decidedly the opinion, in accordance with his general idea of the matter, that the movements in hypnotized individuals are caused by the sensory impressions calling forth, in some part of the brain situated below the cerebral cortex, changes which act immediately as stimuli upon the motor apparatus; that hence the apparently voluntary movement of imitation is carried out, like a reflex action, independently of the will.

Whilst normally the changes produced by the sensory impression in these sub-cortical parts can act on the cortex itself, in hypnosis this way is closed, whilst the by-way to the motor apparatus remains open.

These sub-cortical changes must, however, last

longer than the stimulus, for, after awaking from the hypnosis, it is possible to call forth memory, *i.e.* to let these changes act on the cerebral cortex, when, by repeating the stimulation which caused the original change, a new, slight, and partial stimulation of the changed parts is brought about.

But it is only certain definite forms of stimulation which bring about a definite movement.

To cause a hypnotized person to move an arm, the image of a moving arm must pass over his retina, or an unconscious sensation of motion must be induced through passive movement of his arm.

This fact seems to point to the existence of a central motor mechanism, which carries out a definite movement. This must be in intimate connection with another central mechanism, the stimulation of which, by the nerves of the eye or of the muscles or of the skin, gives rise to certain changes. These, when consciousness is maintained, lead to an idea of the movement in question, but when consciousness is absent, they directly stimulate the corresponding motor mechanism.

A child, guided by its sight and its muscular sense, gradually learns to make co-ordinated voluntary movements.

Guided by stimulation of the eye and of the sensory apparatus of movement, a hypnotized person carries out his movements like an automaton.

PART II.

DESCRIPTION OF NEW RESULTS BY PROFESSOR HEIDENHAIN AND DR. GRÜTZNER.

A.

Symptoms of the Hypnotic State.

I. *General facts concerning the Development of the Hypnotic Symptoms.*

On trying, according to Hansen's method, the susceptibility for hypnotism of a great number of persons, the most numerous cases are those in which the incapability of reopening the closed eyes constitutes the sole unusual phenomenon.

Next to these come a large number of people who cannot, or only with great difficulty, open the closed mouth; consciousness may be at the same time complete.

There is simply a spasmodic contraction of the muscles causing the closure of the eye and mouth, which cannot be, or is only after a series of futile attempts, overcome by the voluntary contraction of the muscles causing the opening of these organs.

In other persons, the spasmodic condition spreads still further over the body. Order them to close their fist and bend their arm, and there is established (either at once, or after gentle stroking along the

limb) incapacity of changing the adopted position of the limb; exactly the same with the extended legs.*

With all these phenomena presented by the motor apparatus, consciousness may, as stated, be quite unaffected; still, often slight disturbances of the latter occur, which are scarcely noticed by the person experimented on.

If questions be asked as to what has occurred, the answers given are generally right. But not seldom some links in the chain are wanting.

Between these easily overlooked defects of memory and complete loss of it, every intermediate stage is met with. The forgotten facts can, however, in some, but not in all cases, be recalled when hints concerning them are given.

In the types just described, the phenomena observed in the muscles form the chief, or, at least, the most prominent features of the picture. In another series of types psychical phenomena, which assume various degrees and forms, prevail.

* The tendency of the muscles, under certain conditions, to pass from a state of strong voluntary contraction into that of convulsive rigidity (contracture), is nothing new. MM. Bussaud and Ch. Richet have described the same fact in the *Comptes Rendu* of September 1, 1879.

It was observed not only in hysterical women, but also in a healthy young man. With regard to the latter, M. Richet writes to me as follows:—"Il est assez remarquable que ces contractures peuvent être provoquées surtout lorsqu'il a été depuis un peu de temps soumis au somnambulisme."

II. *Psychical Phenomena.*

(*a.*) REACTIONLESS SLEEP.

In many people, more or less profound sleep, mostly but not always accompanied by analgesia, alone occurs.

When the tendency to this is present, the sleep can often be most quickly brought about by causing the person to listen, with closed eyes, to the ticking of a watch.

In the case of a soldier, this proceeding acted so energetically that, in spite of the threatening command of his superior officer, he fell asleep time after time during a very short period. The eyelids seemed compelled to droop, in spite of the continual efforts to keep the eyes open.

Dr. B——, whilst standing and listening to the watch, lost his equilibrium directly the sleep began.

Mr. P——, a student, and O——, a nurse, when fallen asleep in a sitting posture, soon let their heads sink on their breasts.

Muscular phenomena may be totally absent during the condition of sleep, or there may be more or less developed catalepsy.

(*b.*) EXCLUSION OF CERTAIN PARTS OF THE BRAIN.

From such cases of general cerebral sleep, must be distinguished those cases in which only more or

less extensive parts of the brain are affected by the inhibition of function. These are far more interesting.

The peculiarity of this state is this: impressions on the sense organs give rise to unconscious perceptions; these originate movements which are closely associated with the sensory impression.*

(a.) *Imitation Automatism.*

To this belong the above fully described imitation movements.

They occurred in their most complete form in eight of the persons we experimented on.†

In cases where they are from the first absent or incomplete, they can be generally produced by repeating the same movement several times before the eyes of the person experimented on.

When dealing with persons hypnotized for the first time, it is best to begin the experiment by slowly raising the arm or clenching the fist in front of them.

If at first no reaction occurs, it does so on repeating the manœuvre; often, however, only incompletely: for instance, they begin to raise the

* See Part I.

† On the significance of this for the genesis of voluntary movement, cf. Lotze, "Medic. Psych." Leipzig, 1852. Gredde, "Die Gesetze der Physiologie und Psych. über die Enstehung der Bewegungen und der Articulation. Unterricht bei Tausbstummen."

hand, but stop half-way, and only complete the movement when the operator makes it again.

In order to induce Mr. M—— to take his watch out of his pocket, the single stages of the proceeding must be repeatedly gone through before him, and he at last, step by step, accomplishes it.

After repeated experiments, these intractable people become quite as precise in their imitation movements as others are from the first.

It is as if the path from the optical to the motor apparatus in the brain became gradually more and more easily passable. When this condition is attained to, the imitation is often marvellously exact, and extends to the most unimportant changes of posture and movements of the experimenter.

(β.) *Speech Automatism.*

Imitation of unconscious auditory impressions, like imitation of unconscious optical impressions, also occurs.

Professor Berger has observed that, on applying pressure with the hand to the neck of a hypnotized person, in the region of the spinous processes of the lower cervical vertebræ, he can often be induced to repeat words spoken in his presence.

It is, moreover, quite indifferent whether the words spoken are intelligible to the person or whether they are in a strange language.

Often the sentences are not completely repeated, but only some of the words they contain.

The repetition is made in a very monotonous tone, which varies in different individuals.

Some talk in a hollow voice, "like one from the grave," as a simple listener remarked; others talk more softly, almost lisping; the same person always in the same way. The phenomenon reminds us of the long-known echo-speech of mad people.

According to Berger, the efficacy of the application of the hand to the neck depends essentially upon the warmth of the former.

But I have found the pressure of a cold hand just as effectual.

The following up of Berger's speech experiment led to the discovery that most persons who repeat words when the neck is pressed, repeat also when one speaks, either simply, or, better, through a speaking trumpet, towards the neck, without pressing the latter; whilst they remain dumb when one talks towards any other part of the head or into the ear.

They repeat very readily and distinctly when the experimenter's speech is directed to the epigastrium; less distinctly when it is directed to the larynx, or through the open mouth to the posterior pharyngeal wall.

One of the persons experimented on, at first repeated nothing; he began, however, gently to do so when pressure was applied to the neck, and later did it without this, but only very incompletely.

If a sounding tuning-fork be applied with its end against one of the sensitive parts, a note like that of the tuning-fork is pronounced, whilst if the sound-waves produced by the strongly vibrating tuning-fork reach the external ear, the person experimented on often awakes with a peculiar expression on his face, denoting pain, and states that a feeling of burning had been felt in the ear.*

One of the media at first repeated nothing, but on pressure being applied to the cervical region, began to speak in a low tone, and later on without the pressure on the neck, but very incompletely.

If, by means of a tuning-fork, the limits of the sensitive area at the epigastrium be marked out it is found that it extends from about two fingers breadth below the sternum for about two inches downwards, and for about the same distance on each side of the median line; whilst the regions of the lateral abdominal walls, of the umbilicus, of the sternum and ribs are absolutely insensitive.

By means of percussion, we find the sensitive area corresponds to a part of the anterior wall of the stomach. Since this organ, and also the larynx and posterior wall of the pharynx, obtain their sensory nervous supply from the vagus, it is pro-

* This was first communicated to me by Professor Weinhold, and was completely confirmed in two cases. Weinhold and Berger have obtained the tuning-fork reaction with other parts of the body than those above named. I have not in this case been so fortunate.

bable that the mechanical stimulation of the latter, by means of sound vibration, renders possible the transmission of the acoustic impressions to the vocalizing centre.

Vagus branches do not, it is true, go immediately to the neck, but anastomoses of the cervical nerves with the vagus exist, the signification of which has hitherto been unknown.*

(γ.) *Automatism at Command.*

We learn from the reports of Weinhold, from a treatise of Demarquay and Teulon,† which is well worth reading, and also from another of Ch. Richet,‡ that, under certain conditions, hypnotized people obey the command to carry out certain actions, and that it is possible to induce dreams in them by talking into their ears.

In the dreaming state they readily reply to questions put to them, and undertake movements in accordance with their dreams.

Unfortunately, nothing of the kind had, until quite recently, been observed in Breslau.

* Since Weinhold and Berger find other regions of the body sensitive to the tuning-fork, it would appear that the vagus nerves are only better, not exclusively, adapted to transmit the acoustic impressions to the articulating centre. With stronger stimulation, other sensory nerves appear to be able to do this.

† Demarquay and Giraud-Teulon, "Recherches sur l'Hypnotism." Paris, 1860.

‡ "Du Somnambulisme Provoqué," *Robin's Journal*, 1875.

Inquiries of Professor Weinhold and of Professor Ruhlmann, of Chemnitz, gave no definite data for the explanation of the cause of the difference of the hypnotic symptoms there and here.

But it seems probable, as has been already stated in previous editions of this pamphlet, that the cause must be sought in the varying depth of the hypnotic sleep.

In an individual who answers to a question, it is certain that parts of the brain are active which are not so in the previously described states.

At a sitting of the medical section on the 13th of February, 1880, Professor Berger made a communication to the effect that a lady he had been treating for months for cataleptic symptoms, obeyed during one of her fits, the order to perform certain actions, as soon as he lightly laid his hand on the crown of her head, and he also stated that the same observation had been made on an artificially hypnotized individual.

Immediately after this meeting, this experiment was tried on my brother with great success, and since he had been at my house during the whole time of the meeting, he could know nothing about Berger's statement.

A glass containing ink was given him, with the request to drink some beer. Without the least hesitation, he began to drink the ink.

He also, on being told to do so, thrust his hand into a burning light, and with scissors so unmerci-

fully cut off his whiskers, which he had assiduously cultivated for a year, that on awaking he was greatly enraged about it.

In short, he did all (with certain limitations to be discussed later) that was asked of him.

Any one who sees such proceedings as these for the first time, is only with difficulty convinced that they are not the result of deception.

I leave out of consideration the subjective confidence I have in my brother, and inquire what reasons there are for excluding this supposition.

They are, firstly, that the actions performed are so very absurd that the person, if he were capable of judging of them, would certainly never do them.

We succeeded in inducing a young man, on the very first occasion we experimented on him, to lick what he supposed to be a snowball in his hand: it really was a frog. During this he awoke, and then threw away the animal with disgust.

Another proof is that this "automatism at command" has been observed to occur, when Berger's manipulation is adopted, in a great number of persons, none of whom had the least idea of the experiments which had been performed on the others.

Long before we in Breslau became acquainted with this most interesting condition, I received from Dr. Meyersohn, Assistant Physician to the Schwerin Hospital, the manuscript of an essay in which he describes, from personal observation, this automatism at command.

In order to preclude all preoccupation in the persons I experimented on, I made no one acquainted with the contents of this interesting paper.*

It has been remarked above that "automatism at command" presupposes a less depth of the hypnotic sleep than does "imitation automatism."

The proof that the application of the hand lessens the sleep, lies in the fact that the person not seldom awakes from the hypnosis when the hand is allowed to gently rest on the top of the head for some time.

With this experience, we endeavoured to make the hypnosis from the first as slight as possible, by diminishing the usual hypnotizing manipulations.

We have, in fact, succeeded; and have not only become acquainted with automatism at command as a primary condition, but have also been able to induce the most vivid dreams, by means of talking them into, as it were, the individual experimented on.

* When the above communicated researches were discussed, we were told from all sides that Hansen, when he wished to make his media perform certain actions, kept one hand on their heads or moved it from side to side. An eye-witness tells us that, in the performance in which he makes a hypnotized person shave another person with a chip of wood, he (Hansen) stroked with his hand the head of the person in question. It was then thought that he wanted to call forth an imitation movement. But now it is scarcely to be doubted that he, by means of the manipulation of the head, had brought about the conditions of command automatism.

(δ.) *Dreaming.*

INDUCED DREAMING—ARTIFICIAL HALLUCINATIONS.

Our experience in this agrees with what Richet* describes. We have only to make the following additions to his statements :—

In one of the persons we experimented on, a tale always excited changes in the countenance corresponding to the nature of the former, *i.e.* if the contents of the tale were pleasant, then the countenance assumed a pleased expression ; the reverse if the subject matter was sad. These changes were very striking.

When the hypnosis was over, the person knew scarcely anything of what he had gone through.

But by giving hints, he was able to call to mind certain parts of the dreams the recitals had excited ; denied however, most definitely, any remembrance of others.

The memory is, therefore, an incomplete one.

Nevertheless, he remembers words heard in the sense spoken of on pages 15 and 16, and actions he had performed even when the objects of these have not appeared as visions.

* Ch. Richet, "Du Somnambulisme Provoqué," *Robin's Journal de l'Anatomie*, 1875. Id. "Les Démoniaques d'Aujourd'hui," *Revue des Deux Mondes.*

In other persons, the dreams themselves are more vivid, but for the most part are only then remembered when the medium afterwards hears expressions bearing on their subject matter.

The more objective the dreams are, the more marked is the impression it causes.

I made one gentleman dream he was in the dissecting-room, and told him, at the same time putting a bone into his hand, to remove the heart from the thorax of a dead body, and to display its cavities *secundem artem.* All the appropriate movements were slowly but correctly carried out.

Then I took him (still in dream) to the Zoological Gardens, where I made an escaped lion appear. Any one who saw his starting back and the expression of terror on his countenance would have no doubt as to the reality of the vision.

To overcome the evident feeling of extreme anxiety, I said to him, "I will shoot the lion," and imitated the report of a gun.

But the expression of anxiety increased till the whole body trembled violently.*

On awaking, a shuddering sensation, described by the gentleman as extremely unpleasant, lasted for about ten minutes.

Questions, appropriate to the occasion, put to the medium during the condition of hallucination, are answered readily. In this way a conversation

* Professor G. S. Hall, of Boston, was present during this experiment.

can be got up and continued, when the relation with the subject of the dream is maintained.

A student I took (in dream) to a *commers* * answered all questions with answers quite adapted to the occasion.

Another, as we had agreed to travel, correctly indicated the way to the railway station, alighted at the station for his home, recognized his father there, and began addressing him.

In short, we have seen all that is so graphically described by Richet in his above-cited essay.

We abstain from describing further the almost dramatic scenes which can be produced by exciting hallucinations; for the details would teach us nothing more of importance than is contained in the above general account.

Such artificially produced conditions formed, no doubt, the basis for the marvellous representations of the somnambulism and clairvoyance of earlier times; intentional deceptions being, however, used in addition.

Discussion of the Psychical Phenomena.

The explanation given above of movements of imitation was as follows:—Normally a conscious idea of the movement, through the intermedium of the will, gives rise to the performance of the projected movement; in the hypnotic state, the inhibi-

* *Commers* is a festive gathering of students.

tory power of the will being absent, an "unconscious perception" of a movement acts as a direct stimulus for the central motor apparatus.*

The speech automatism and command automatism can be referred to similar processes.

In the normal state, the uttering of a word is preceded by the development in consciousness of a "sound picture" (*klangbild*) of this word, which with the interaction of the will, gives rise to the articulation of the word.

In a hypnotized person, an unconscious "sound picture" acts as a direct stimulus for the articulating centre, if such conditions are established that the innervation path between the place where the sound picture arises and the articulating centre is free from those inhibitory obstructions which normally exist as the result of the will and consciousness.

In a normal person, an order to do a thing brings about an idea—a mental picture—of the thing ordered; the will allows this to act on the motor central organs, and the order is carried out. During hypnosis, instead of the conscious mental picture, there is established, through the impression on the auditory apparatus, an *unconscious* mental picture of the projected action, which acts as a stimulus

* See above, pages 11–13. In rare cases, both in imitation and in speech automatism, consciousness may be so far maintained that sensory perception is possible, whilst the inhibitory power of the will is wanting.

to the motor apparatus, if the nervous path connecting the two mechanisms is, in the absence of the inhibitory influence of the will, easily passable.

Imitation automatism, speech automatism, and command automatism thus all depend on similar processes. The unconscious optical impression acts on the motor apparatus, the unconscious auditory perception upon the articulation or motor apparatus, provided the paths between the sensory perceptive centres and the motor centres in question are directly free for the transmission of nervous influences. This, however, is the case when the normally active inhibitory power of the will is rendered functionless.*

The most complicated process is evidently the command automatism.

For in imitation automatism and speech automatism, the experimenter by means of certain actions induces similar actions (through movements or words, likewise movements or words).

In command automatism, on the other hand, through his actions he calls forth dissimilar actions (*i.e.* through his words, actions).

How far the hypnotized person is influenced in carrying out his actions by sensory impressions

* Any one who has been engaged with Lotze's theory of the origin of voluntary movement, will observe what an intimate connection there is between the phenomena observed in hypnotized people and the theoretic considerations of this talented philosopher (see "Medic. Psychologie," book ii.). Further considerations on this point are reserved for a later complete description of hypnotism.

other than auditory, is difficult to say if, as is often the case, the condition of pure command automatism is connected with that of hallucinations.

Those cases are most instructing in which the former alone occurs. Here only the most simple, every-day actions are accomplished, purely mechanically, without any judgment concerning either the request or the carrying of it out.

If the demand be made indirectly there is no reaction.

For instance, I say, "I should like to know the time; I wish I had my watch"—this expression is without any effect.

If I say, "Show me your watch," he at once does so. Thus the sentence does not set up a complicated process of reflection, and leads to no conclusion which could result from such a process, but only then gives origin to the action, when the words spoken denote immediately the action in question.

For the command to be obeyed it must be complete.

For instance, if I say, "To the door," nothing results; if I say, "Go to the door," then the medium walks a few paces, not, however, towards the door, but in a direction depending on his immediate position, just as if I only said, "Go."

The action is, therefore, carried out purely automatically.

When requested to pass something, the medium

makes uncertain movements with his hand, as if feeling for something, unless the article asked for be in some familiar place, *e.g.* in his own pocket or on his own table. If he happens to touch an article any way resembling that which is wanted, he takes it and uses it as if it were the desired object ; *e.g.* a chip of wood as a knife, a candle as a test-tube, etc.

Hence it seems that, in automatism at command, only the direct command is effective; no guiding or correcting influence is exerted by distinct perceptions.

Whilst in the phenomena hitherto considered, the impressions on the sense organs of the medium give rise to movements, in the dreams or hallucinations these impressions call forth visions and actions connected with these dreams.

The observations made in regard to this point are in close connection with the experience of daily life. For it is an acknowledged fact that sensory stimuli, acting on a sleeping person, often provoke corresponding dreams ; that also, in normal sleep, people can be talked into having definite dreams ; and also, that sleeping people often answer questions.

The psychologically interesting point lies in the abolition of self-consciousness, whilst external influences still call forth ideas and actions (which, it is true, take their course without there being any rational judgment) with which they would normally be accompanied.

The dreams most easily provoked are those the subject of which is in some connection with the every-day life of the medium.

A mathematical student could be induced to draw geometrical figures on the wall with a porcelain crucible ; a medical student to test urine over a spirit lamp, which was not however lighted.

The dream pictures produced during hypnosis leave behind, in the cerebral organs, traces which can later, again produce a most decided effect.

A case of hallucination is quoted above, in which the student is taken first to the dissecting-room and then to the Zoological Gardens ; in the former place he had removed the thoracic viscera, in the latter he was frightened by a lion.

As the same gentleman, on the evening of that day, was again sunk in hypnotic sleep, all the gestures and movements which had accompanied the dreams of the afternoon, returned spontaneously and in the same order.

After awaking, it was ascertained that the whole dream had been again experienced, and also the uncomfortable creeping sensation, but this time more especially in the course of the ulnar nerve.

Some minutes later, the little and ring fingers and the ulnar side of the arm broke out into perspiration.

In the following night both dreams once more occurred during quite normal sleep.

No doubt, then, that the processes started up by the speech of the operator in those parts of the brain which preside over visual ideation, leave behind material changes which last for some time, and occasionally, under favourable circumstances, become again * effective.

Special Phenomena of the Motor Apparatus.

The following observations are to be added to those on pages 20–28.

The disturbances of the sensorium may exist without being accompanied by striking motor disturbances. This is the case in simple, deep reactionless sleep, but also in persons presenting more complicated phenomena, *e.g.* lively imitation, hallucinations, etc. Other persons show exactly the opposite condition ; in them, every hypnotic experiment produces at once marked tonic and clonic spasms, which warn us to be cautious.

When this has taken place at the first experiment, we have never repeated the experiment.

Between these two proportionately seldom extremes lies a series of cases, in which various disturbances of the motor apparatus have been observed during the hypnosis, having either been

* Charcot says of hysterical women, that in each the same hallucinations constantly appear.

present from the first, or induced by some special cause.

They can be stated as follows:—

1. More or less extensive cataleptic rigor becomes established; the limbs thus affected remain in any imaginable position they are placed in.

The will has, it is true, not wholly lost influence over them, but it is exerted with very great difficulty. If, however, with a great effort, the parts be set in activity, there often results, instead of simple, convulsive movements which spread to other parts of the body.

2. Reflexly, by gently stroking the skin, tonic contraction of the muscles can be caused; which spreads from the point of irritation in definite order to other parts. It has been fully mentioned above that, if this increase of irritability is very marked during the hypnosis, it continues for a long time after the latter is over. But we can add, from new observations, that this gradually and completely disappears, if during the further experiments, everything giving rise to convulsions be avoided, and thus no movement, reflex or voluntary, be allowed, or if the experiments are entirely left off for a time.

In the nervous central organs there are anatomical connections between definite sensory and motor nerves, which are so arranged that the stimulation of the first sets the latter into activity, and hence the muscle it supplies.

The connecting link between these two kinds of fibres is constituted by groups of ganglion-cells of the brain and spinal cord. These transmit in a definite manner the irritation of the sensory to the motor nerves. During hypnosis this transmission is rendered so exceedingly easy that, in that condition, reflex phenomena readily occur which in the normal state are not met with.

Professor Goltz found, years ago, that a frog whose cerebral hemispheres had been extirpated, croaked every time the skin of the back between the scapulæ was gently stroked with the finger (thus causing a slight dragging upon the sensory nerve).

This observation demonstrated a reflex connection between certain sensory nerves of the skin of the back and the motor articulating centre in the medulla oblongata.

In the human subject, a similar connection exists between the sensory nerves of the neck and the articulating centre in question ; for a number of hypnotized persons emit a sighing tone, produced by a resounding expiration, when the skin of the neck, over the fourth to the seventh cervical vertebræ, is dragged downwards by the pressure of the fingers.

This experiment makes it *à priori* probable that other reflex phenomena, known to us from experiments on animals, would also occur in hypnotized men.

According to the observations of Goltz, in dogs whose spinal cord has been cut through at the level of the twelfth dorsal vertebra, after the wound is completely healed, a series of reflex movements can be brought about by means of the separated lumbar cord as a reflex centre.

In such animals, tickling the skin near the lumbar vertebræ brings about scratching movements in the hind leg of the same side ; tickling the perineal region gives rise to micturition.

Both these reflex phenomena occur in hypnotized men. If the hypnosis be induced whilst the person is standing up, and the skin at one side of the last lumbar vertebræ be stroked so as to produce a dragging downwards of the skin, the leg of the side stroked is moved clumsily backwards, and hence a step backwards is made by this leg.

Alternate stimulation of this area of skin on either side causes alternate backward movements in both legs. In this way the person experimented on can be made to walk backwards, with short steps, the whole length of the room.

Frequent repetition of the stimulation on one side causes the corresponding leg each time to make a slight backward movement, so that at last a position is attained with extreme separation of the legs, as if a very broad ditch was being spanned.

Stimulation of definite parts of the skin of the trunk constantly produces localized reflex move-

ments; in the determination of these Dr. Born has kindly assisted me.

Gently stroking the skin of the back at the sides of the spinous processes of the upper dorsal vertebræ causes elevation of the arms, with simultaneous slight flexion, so that the hands tend to meet above the head.

Stimulation over lower dorsal vertebræ produced contraction of latissimus dorsi and rhomboidei, with resulting powerful backward movement of both arms and simultaneous flexion.

Stimulation over last dorsal and first lumbar vertebræ caused tonic contraction of the whole erector spinæ, with simultaneous elevation of the ribs (levatores costarum, intercostales), without accompanying contraction of the diaphragm, and hence passive sinking in of the abdominal muscles.

Stimulation over the lower lumbar vertebræ and sacral region, the person being seated, caused contraction of flexors of leg, then of the Ileo-psoas, and hence, the thigh being fixed owing to the sitting posture, the trunk was drawn down towards the thigh.

Stimulation of the skin near the sternum: strong contraction of the pectoralis major, so that the arm was drawn to thorax; simultaneous stimulation of the extensors of arm.

These reflex movements, which depend on the

spinal cord and medulla oblongata, represent a new series of phenomena in hypnotized persons, for previously only imitation movements, or such movements as had been passively induced by the operator, were known.

It is certain that methodical investigation of the whole surface of the body would lead to the discovery of many more reflex relations.

The following observation, which can constantly be made, belongs also here :—If, when a person is being hypnotized by the method of fixed staring, the operator steps slowly aside, the eyes of the medium follow exactly the movements of the operator, the fixation being continually maintained.

The changes in position of the retinal image produces, therefore, a reflex contraction of the muscles of the eye, the object of which is that the image of the operator may still fall on the spot of most distinct vision.

The operator being the object of the fixed gaze of the medium, when the operator has passed so much to the side that movements of the eyes alone are insufficient, then the whole head of the medium turns, so that the fixation is always maintained.

B.

CONDITIONS FOR THE ESTABLISHMENT OF THE HYPNOTIC STATE.

From many quarters we hear the complaint that the establishment of the hypnotic state very seldom succeeds; the reason for this undoubtedly lies, for the most part, in the incomplete carrying out of the necessary process, which in the main is the same as that used by Hansen.

When we test the irritability of any person, we proceed as follows:—

Firstly, he is made to gaze fixedly at a shining faceted glass button * for some six or eight minutes, the visual axes being made to converge as much as possible.

As Braid observed, the most advantageous direction of the visual axes appears to be that of upward convergence.

In some persons this alone suffices to produce hypnosis, but as a rule it does not.†

* We are often asked what kind of a button it must be. Every glittering piece of glass, *e.g.* the glass button so often used on ladies' clothes, fixed upon a dark ground, is efficacious. The special form is unimportant. A polished metal ball, etc., can also be used. Staring at dark objects often leads to the required result, but glittering ones are decidedly preferable.

† Of the usual empirical manipulations employed at the present day for the production of hypnosis, only the hand passes were employed by the magnetizing physicians of the first decade of this century. The staring at a bright object was introduced by Braid. Still Egyptian conjurors used, many centuries ago, the fix-

After the above-stated time has elapsed, we stroke over the face without immediately touching the surface, from the forehead to the chest, after each pass bringing the hands round in an arc to the forehead again. The hands must be warm.

During the stroking we either allow the eyelids to be closed or gently close them.

After ten or twelve passes we ask the person to open his eyes. When this occurs without hesitation, or with only slight difficulty, we again make the person stare at the glass button for some six minutes, and then repeat the passes.

When this repetition is omitted, many individuals capable of being hypnotized certainly remain undiscovered.

If now the eyes cannot be opened, we proceed, having closed the mouth, to stroke the cheeks, in order to see whether the mouth can be opened again or not.

A similar proceeding is adopted with the bent arm and clenched fist.

ation of the eyes with cabalistic signs on a white plate to produce hypnosis.

Being convinced that Hansen uses the most expeditious method, we have mostly kept to his mode of procedure.

In the fixation, the convergence upwards of the visual axes is very important; it suffices of itself in blind people, or in the night, to produce hypnosis (Carpenter, "Sleep," in Todd's Cyclopædia). Yet the influence of the exertion of the muscles of the eye is decidedly assisted by the simultaneous action of the shining object.

The following passes with the hand often bring about the hypnotic state when the simple fixation does not succeed; many people definitely state that they first get the sensation of approaching sleep when the passes are made.

In persons in which the latter is no longer possible, most of the above-described hypnotic symptoms can be observed.

As a general rule, the sensitiveness for hypnosis increases after repeated experiments, so that in later trials the fixation of the glass button may be omitted.

It is beyond question that, in the bringing about of the hypnotic state, psychical influence comes into play.

If, during the fixation of the glass button, the attention be otherwise occupied, either by a noise in the neighbourhood or by deep reflection, the first attempts at hypnosis are usually unsuccessful.

The cause for this is not far to seek.

In hypnotizing it is a question of acting on the sensorial ganglion-cells of the cerebral cortex.

But it is a well-known physiological fact that ganglion-cells, which are already active, are only with great difficulty influenced by new impressions.

If, in a brainless frog, the sciatic nerve of one side be strongly irritated by an electrical current, it is found very difficult, or altogether impossible, to induce reflex movements in the other leg by means of cutaneous stimulation, because the ganglion-cells bringing about reflex action are so occupied by the strong stimulation of the sciatic nerve that they are unaffected by the slight cutaneous stimulation.

In a similar way, the sensorial ganglion-cells appear less sensitive to hypnotizing stimuli when they are otherwise occupied.

Hence it happens that such stimuli which produce hypnosis when the attention is directed to this latter, fail to do so when the attention is engaged elsewhere.

Instead of citing numerous observations of our own, we will here bring forward an interesting communication of Professor Rühlmann, of Chemnitz :—

"A young lady, who was particularly well adapted for hypnotic experiments, was able, without any signs of hypnosis coming on, to listen to the ticking of my watch when I directed her attention to the fact that, by very careful listening, the movement of the escapement and catch could be heard.

"This was at the tea-table.

"An hour later, I requested her to allow me to show some experiments on her, and by listening for two or three minutes to the ticking of the same watch, she was so deeply hypnotized as to be insensible to the prick of a needle."

This statement, however, only holds good for persons whose susceptibility has not reached a very high degree. When this is the case, the hypnosis can be produced, especially by acoustic stimuli, even against the will of the person affected.

Moreover, in individuals of very great irritability,

the highly developed idea of the approaching sleep is enough of itself to really induce the hypnosis.

Many of the gentlemen upon whom the above experiments have been made, need only to sit down, close their eyes, and think intently—other thoughts being excluded—that the hypnosis is coming on, in order to, as it were, voluntarily submit themselves to the charm.

This disposition of very irritable persons once known, it can be made use of to carry out the maddest, and to most persons totally incomprehensible, nonsense.

Mr. Friedländer, a medical student, who has been very often hypnotized, was told, on the morning of the 1st of February, that precisely at four o'clock in the afternoon he would, in his own room, on looking at the clock, be magnetized by means of influence, *par distance;* and that he was to look at the clock a little before four, in order to see how the time was going.

Dr. Rügner, a relative of Friedländer, acted as umpire, and observed an entirely successful result.

A similar experiment succeeded with two other persons, by making them look, at a specified time, at the clock.

In the same way that we can make use of a previously specified hour, so can we use a previously specified place, to which the person is to go, or a previously agreed upon object, at which the person is to look, in order to accomplish the hypnotizing.

when the operator is at any imaginable distance from the medium.

Every method of exciting strongly the thought that the sleep is coming on brings about the latter.

In this way, to what superstition is door and portal thrown open for the uninitiated!

Finally, we may here make a few observations concerning the awaking from the hypnotic state.

In addition to strong stimulation of the sense organs, every change in their existing condition of stimulation readily brings about awaking.

Bright light falling on the retina; change in the retinal image, when the medium has been staring at an object and suddenly another takes its place; application of cold (as by blowing) when the skin is warm, or of heat if the latter be cold,—all these suffice to dispel the hypnosis.

But not only the hypnotic sleep, but also the local hypnotic symptoms, can in this way be removed.

The local spasm caused by acting on the skin can, in a waking medium with increased reflex irritability, be removed by the action of cold (*e.g.* cold stream of air, ice to skin).

Undoubtedly, too, the soft stroking over the skin in a direction opposed to the original one, must be considered as a change of stimulation.

For instance, if an arm has been thrown into spasmodic contraction by stroking the ball of the thumb from above downwards, the spasm is in most cases removed by stroking in the opposite

direction. Complete hypnosis, induced by passes from forehead to chin, often goes when the reverse passes are made.

Hence, in producing hypnosis by passes over the face, the hands must not move in the same way up again as that in which the downward movement was made, because the second movement neutralizes the first in a similar way that constant change in the retinal image acts prejudicially.

C.

UNILATERAL HYPNOSIS.*

I. *Phenomena in the Motor Apparatus.*

As some time ago one of us (Grützner) was occupied in making hypnotic experiments on non-medical people, Dr. Kayser, who was accidentally present, remarked it might, perhaps, be possible to produce unilateral hypnosis by acting only on one side of the head or face.

In fact, in one of the media, by means of gentle pressure upon the forehead and temple of one side, the influence of the will upon the extremities of the other side could be removed, or, at any rate, to a great extent lessened.

The experiment was however for a time for-

* Cf. Heidenhain and Grützner in *Breslauer Ärztlichen Zeitschrift*, No. 4, 28th February, 1880 (Communication of the 10th February, 1880).

gotten, since it failed when repeated a few days afterwards on three other gentlemen.

Somewhat later, one of us found that his brother (Mr. Heidenhain) was so influenced by stroking the left forehead and temple, that after a short interval, immobility of the right arm and leg was brought about.

A blow with the totally unaffected left arm upon the right arm instantly removed the paralytic state.

Since then repeated experiments have constantly given the same result.

With slow, repeated stroking over the skin of the left temple, a paralytic state of the extremities and facial muscles is produced.

It is only with great difficulty that the right arm can be a little raised; the right leg, when extended in sitting, can be neither flexed nor adducted.

Only with the greatest efforts are feeble movements possible, and then they very frequently become convulsive.

In laughing, the right cheek remains perfectly immovable, just as in paralysis of the facial nerve.

The immovable parts can be moulded, however, like wax. They remain in the position given to them for an indefinite time, either directly, or after having kept them for a short space in this position.

Moreover, it is perfectly impossible for the medium to pronounce or repeat words, since the co-ordinated movements of articulation cannot be carried out (ataxic aphasia).

When the corresponding cutaneous area on the right side is stroked, all the above phenomena appear on the left side, except the aphasia, which is completely wanting.

If both sides are simultaneously stroked, then the cataleptic condition is established in the limbs of each side. But no disturbance whatever is seen in the speech or in the facial movements.

If the left side of the head be first stroked, and hence, together with the right-sided paralysis, the aphasia and the facial paralysis be produced, then both of the latter phenomena disappear if, later on, the right side of the head be stimulated simultaneously with the left side, whilst the catalepsy now affects the hitherto free left limbs, so that now all four limbs are affected.

If, however, the left side of the head be first stroked alone, until the oft-mentioned result is obtained, and thereupon the manipulations on the right side be alone carried out, then the aphasia and facial paralysis disappear, and with it the right-sided catalepsy ; after a short time, however, in which all four limbs are movable, left-sided catalepsy makes its appearance.

Hence—

Stroking on both sides causes catalepsy of all four limbs ; no facial paralysis or aphasia.

Unilateral stroking causes crossed catalepsy and facial paralysis, when on the left, accompanied by aphasia.

If, in addition to unilateral stroking, and this being still maintained, the other side be stroked, then the same result is brought about as if both sides had been stroked from the beginning.

If the unilateral stroking be interrupted, and stroking of the other side substituted for it, then the phenomena are the same as if the second side had alone been acted on; for the result of stroking the first side disappears, whilst the result of stroking the second side appears.

Unilateral hypnosis, induced by stroking one temporal region in a direction from before backwards, is generally removed by stroking the same region in the opposite direction.

Measurement of the volume of the arm by means of Mosso's volumeter proves that in the cataleptic arm the quantity of blood (in consequence of the vascular contraction) sinks enormously, whilst it simultaneously rises in the other arm.

When the catalepsy is gone by, the quantity of blood in the cataleptic arm increases, whilst in the other arm it sinks.

In all these experiments consciousness is not in the least affected, and no unpleasant sensations accompany them.

The investigation of these phenomena in a series of other persons gave similar, but still somewhat different, results.

In the case of Mr. P——, all the phenomena were the same as those just described.

But in the case of Mr. W——, unilateral stroking causes unilateral catalepsy, but on the side which is stroked. The aphasia can only be produced by acting on the right side of the head.

With two other gentlemen, the unilateral effect occurs sometimes on the same side, sometimes on the opposite side.

Professor Berger, who, independently of us, has observed unilateral hypnosis, has arrived at the result that in such cases stroking the forehead produces crossed catalepsy; stroking the temporal region, catalepsy on the same side.

In one case we find this, in fact, to be true.

In Mr. F——, gentle pressure upon the left temporal region very readily produces ataxic aphasia, but it produces no cataleptic condition in the limbs. The same with Mrs. B——. Both recover the power of speech by means of pressure upon the right temporal region.

In Mr. S——, pressure upon the right temporal region produces, besides aphasia, tonic adduction of the left arm, whilst the right arm remains free.*

* It is best, when it is required to test sensitive persons for unilateral hypnosis, to make them sit down, and then to stroke gently one parietal region, or press gently with the warm hand. If then, after this has been done for about thirty seconds, the person raises his arms, he experiences in one a feeling of weight, as a consequence of which this arm is not held so high as the other.

If the stroking, and especially pressure, be continued, the arm becomes more and more paralyzed. When violent efforts are made to raise it, cramps appear.

This artificially produced condition can be at once dispelled by a strong blow on the limb.

More minute examination of the disturbance of speech leads to the discovery of notable differences in different individuals.

The inability to speak seems to depend on the fact that, in the endeavour to articulate, the voluntary muscles used in articulation are partly thrown into the condition called contracture.

However, it is only the laryngeal muscles, for the mouth can be opened, the tongue protruded and freely moved.

In other cases the mouth can only be with great difficulty, or not at all, opened, particularly when previously it has been energetically closed ; similarly, the voluntarily opened mouth cannot be shut.

All the facts indicate that the cause of the disturbance in speech depends on the voluntary muscular contraction passing into persistent "contracture," as observed by Richet and Brissaud.

It depends on this process, that the power of speech is lost when the medium, whilst engaged in speaking, is hypnotized by means of fixation.

The command over the movements of articulation is lost, since some of the muscles necessary thereto fall into a state of persistent shortening.

II. *Sensory Disturbances.*

In the hypnosis produced by stroking the skin over one temporal area, very remarkable disturbances are observed in certain sensory processes on the affected side.

It has occasionally been observed, but not as yet more nearly investigated, that the distinguishing between hot and cold by the cataleptic arm was rendered very difficult. In two persons it was found that they could no longer with certainty distinguish when they were touched with a glass full of hot water and when with one full of cold.

It is thereby very remarkable that sensation of changes of temperature requires a much longer time than the simple sensation of contact. We have not further pursued this subject, because another one attracted our attention much more, viz. a disturbance in the process of accommodation and in the perception of colours in the eye of the cataleptic side.

We have already considered the accommodation spasm at the commencement of the hypnosis.

In unilateral hypnoses this occurs only on the cataleptic side, whilst the other side is unaffected.

From the very exact measurements made by Professor Cohn on my brother, the spasm of the accommodation apparatus is so great that the near point is only twenty millimètres from the eye.

In a series of persons, but not in all, besides this spasm of the ciliary muscle, a very remarkable disturbance of the perception of colours occurred.

My brother became completely colour blind in the eye of the cataleptic side—the exact investigation of Professor Cohn, carried out with the aid of all modern appliances, leaves no room for doubt on this point.

The condition of the eye corresponds to that represented in Stilling's new Atlas, Table iv. *b.*, l. 1, 2.

All colours appear grey in different degrees of brightness, from a dirty dark grey to a clear silver grey.

As the result of manifold variation in the experiments, the following observations must be added to those of Cohn:—

Whilst objective colours produce no specific sensations, subjective sensations of colour arise when the hypnotized eye is moderately pressed and the pressure suddenly diminished.

If the hypnotized eye be kept closed or covered with a dark curtain for some time and then suddenly exposed, whilst at the same instant a coloured disc be held before the eye, then the latter appears for the first moment coloured; but not with the actual, but with the contrast colour (therefore, *e.g.*, green when it is red). But directly after it appears grey, just as it does when the eye has not been allowed to rest.

If one eye be treated with atropin, whilst the effect of the latter is making its appearance, the phenomena of colour blindness are changed as follows:—

Red and green still appear as different shades of grey.

Blue and yellow, on the other hand, do not appear grey. They appear differently in the different stages of atropin action.

First stage. Yellow appears grey with a glimmer of blue.

Second stage. Yellow appears pure blue.

Third stage. Yellow appears blue, with a slight tinge of yellow, somewhat as in the so-called struggle of the fields of vision. Yellow is seen, as it were, through a blue mist.

Fourth stage. Yellow appears mostly yellow, with a slight tinge of blue.

When blue is tried, the corresponding result is obtained ; that is, at last, blue with a slight yellow tinge is seen.

During the action of atropin the sensation of yellow or blue passes from grey through the contrast colour to the right colour, whilst red and green only appear as different shades of grey.

Professor Cohn has found that the changes occurring during hypnosis in the one eye can also be produced by slightly warming the other eye, *e.g.* by laying a warm finger on the upper lid. In the first eye a still stronger accommodation spasm is produced than that arising in unilateral hypnosis produced by stroking the temporal region at the same time the disturbance of the colour sense appears, so that each colour is seen, first in its actual tint, then as the contrast colour, and a little later as grey.

The phenomena of the disturbance of the colour sense occur, therefore, in reverse order to that in which they disappear during the action of atropin.

Since atropin removes the accommodation spasm, and simultaneously the colour blindness, a causal connection between the two phenomena is suggested.

But in the strongest spasm of the accommodation produced by eserin, the perception of colours is quite unchanged, and in hypnosis in many people the accommodation spasm occurs without the colour blindness. Hence it appears that atropin has a direct action upon the elements concerned in the perception of colour, and to free them from the change in their activity produced by hypnosis.

The results we have obtained on my brother by means of atropin, and those Cohn has obtained by means of the method of local application of warmth, explain some phenomena which had been already observed in other persons.

Mr. P—— sees, during hypnosis, all colours shown to him, first as grey, then in the contrast colour, which constantly remains.

If his eye be treated with atropin, then, in spite of the hypnosis, he sees all colours correctly, after a brief impression of grey.

Mr. W—— sees, during unilateral hypnosis, at first everything grey ; after some seconds this becomes mixed with the contrast colour ; and lastly the real colour appears. An experiment with atropin was not made.

P—— and W—— see, therefore, without atropin, like my brother does during the influence of

atropin. In two other persons the change in the colour sense is different from day to day.

Mrs. K—— was, when unilaterally hypnotized, at the first examination completely blue-blind.

On the next day, however, when coloured discs were presented to the rested eye, she saw first grey, then came varying tints, until at last the right colour appeared.

Dr. S—— sees, with his hypnotized eye, first a definite colour, which gradually passes through other tints to grey.

The final grey always appears, but the other colours vary in different experiments.

Just as the aphasia produced by acting on one temporal area disappears when the temporal region of the other side is stroked, so does the disturbance in the colour sense.

It is scarcely to be doubted that the whole of these interesting facts afford an important addition to the theory of colour perception.

Yet it would be at present premature to turn it to account until more material has been collected.

That there is still a great deal to be found out in this matter appears certain from one of Professor Cohn's results, according to which a person naturally completely colour blind distinguished, when in the condition of unilateral hypnosis, colours which in her normal state were for her totally indistinguishable.

III. *Disturbances of the Sensorium in Unilateral Hypnosis.*

It has been above stated that in unilateral hypnosis the sensorium is apparently completely unaffected.

Hence it would follow that one hemisphere of the brain fully suffices for all psychical functions.

But certain more exact observations teach us that the connection between sensations or perceptions and movements in unilateral hypnosis does suffer a certain disturbance.

As has been already noticed (*Breslauer Ärztl. Zeitschrift*), there appears, in a person hypnotized on the left side, a certain difficulty in fluently writing with the right hand, which however in other respects is completely movable.

In fact, the handwriting acquires a completely foreign character; the letters are very close together, and not seldom a letter is written turned round the wrong way as it were.

In another person the reversal in direction of the writing never makes its appearance, but the writing is much closer together, because the movement towards the right in writing is difficult, and hence the strokes made to the right are involuntarily very much shortened.

This observation renders it likely that the power over the movements of the fingers and hand is altogether diminished—a supposition which has

found confirmation in a peculiar way, in three (examined for this purpose) persons, all of whom were examined independently of the others.

The left side is hypnotized, the left arm cataleptic.

This latter is put in such a position that it is adducted and semiflexed at the elbow-joint and extended at the wrist, so that the left hand is about over the epigastrium, the palm directed inwards, the back of the hand outwards. The thumb is adducted, so that it forms an angle with the hand.

The person is then requested to move one finger of her completely movable right hand in a circle round the thumb of the left hand, in a definite direction, and to continue this movement uninterruptedly.

At the same time, she is to look at the hand of the experimenter, who sits before her and demonstrates the movements to be made.

Now, as soon as the experimenter suddenly stops in his movement, she also does the same for a moment, then recollects and continues the prescribed movement.

When the experimenter reverses his movement, the person experimented on does the same for a second, but soon after corrects herself voluntarily.

I particularly remark that, in the normal non-hypnotic condition, all three persons always carried out the required movement without being in the least led astray by the operator.

Hence there arises, in unilateral hypnosis, a tendency to imitation, which is for the moment obeyed, but which can be overcome by an effort of the will.

Upon the same circumstance depend other observations which are only variations of the former.

The person experimented on is to trill upon the back of the left hand with two fingers of the right—always the same two fingers, and always on the same side of the left hand—whilst at the same time he is to look at the experimenter, who makes similar movements.

When the experimenter suddenly leaves off the movement, the person also does this for a short time; when the former abruptly changes the fingers moved, the latter does so too for a time; or when the former moves his hand suddenly to the left, the latter involuntarily follows the movement with his hand—all of which are imitations which are begun, but shortly afterwards broken off, and which can be corrected by means of an effort of the will.

Mr. S——, who is an able pianist, so that in his case the movement of each finger of the right hand is independent of that of the others, makes every effort to maintain this independence during left-sided hypnosis, but in vain.

So long as the same movement in which he is engaged is constantly displayed to him, he follows it with great ease; any sudden change induces him

to make the same change, in spite of his endeavours against it. When not hypnotized, he never by any chance does this.

The involuntary imitation is liberated by means of the eye of the cataleptic side; when this is covered over, the imitation ceases.

If a proof was still required that the imitations in hypnotized people are not a consequence of a voluntary action, such a proof would be given by these observations.

They illustrate also the rare cases in which, in total hypnosis, in spite of consciousness being retained, movements of imitation are made.

At the same time, it results from these researches that the movements of each arm are influenced not merely from one cerebral hemisphere, but to a certain extent from the other.

D.

On some Objections made with regard to Hypnotic Experiments.

With the number of facts which the experiments at present made concerning hypnotism have brought to light, our confidence increases that we have in this method a means of investigating the functions of the brain, the place of which can be supplied by no other method of observation.*

* Another highly interesting side of the scientific study of hypnotism lies in the explanation concerning the causes of numerous

The greater the probable advantage for the investigator appears likely to be, the more seriously and conscientiously must he consider whether he is not risking too much.

He would be doing so if the objections which here and there crop up, concerning the evil consequences of hypnotic experiments, were to prove to be at all seriously justified.

Such objections were made by no one earlier than by myself; and I have kept this most important point always and most conscientiously in mind.

They were specially called forth in my case through the convulsions which, under certain conditions, appear in hypnotized persons.

I then did not know that the magnetizing disciples of the healing art of the old stamp considered the appearance of these convulsions important, as indicating the crisis of the disease which was being treated.

But I do not lay much weight upon the statements, often accompanied by so many fantastic notices, of the first ten years of the present century, and confine myself entirely to my own experience and that of other reliable and unimaginative observers. The following remarks have origin from this source alone:—

When I have met with persons in whom an

incredulous stories, the real pith of which undoubtedly depends on the hypnotic condition, especially hypnotic hallucination, of course more or less hidden by the additions of the superstitiously excited imagination.

attack of convulsions constantly accompanied every hypnotic experiment, I have never continued to make observations on them, but completely excluded them from the experiments.

Whether the fear of producing evil after results is justified or not, I cannot say.

But it appears to me to be better to be over cautious than not cautious enough.

Such persons appear to be very few in number: I have only met with two. In by far the majority no convulsions occur, unless they are intentionally induced, which now, after the reflex phenomena have become known, is quite unnecessary, or they can with ease be suppressed at any moment by methods which have previously been mentioned.

I have not the least knowledge of any other symptom whatever which could give rise to anxiety.

A few have, on awaking from the hypnosis, a heavy feeling in their head, just as every one has on awaking from a very sound sleep.

This sensation, it appears to me, particularly then occurs when the hypnosis is too suddenly and through forcible means (rough shaking and loud crying) dispelled, or when the condition has been allowed to last a very long time, both of which circumstances are easily avoided.

Some women said they felt a feeling of fatigue in the limbs for several hours—a phenomenon which, as is well known, often occurs after waking from deep normal sleep.

I find, as the result of my observations, that these subjective symptoms, if they occur in the first and second hypnotic experiments, do not re-occur in the later experiments.

Once nausea has been complained of on awaking. M. Richet, whom I requested to communicate to me his experience concerning any after effects, has here and there, but very rarely, seen this, where he had made the hypnotic experiment soon after a meal. These are, however, all the after effects I have seen in a very great number of experiments.

M. Richet, who enjoys an experience of several years, says, in a friendly letter to me, "Je n'ai jamais rien vu survenir de grave."

One only of his friends suffered after every experiment from a certain degree of nervous irritability, which lasted twenty-four hours.

If I were to meet with such a case, I would not repeat the experiment on the individual in question.

Richet's opinion is all the more valuable, since he had at his disposal the materials gained from the Salpetrière, where, in the department for hysterical women, presided over by Charcot, hypnosis is very frequently induced in the same woman for a long period.

In the literature of the subject, I have sometimes met with the remark that hypnotized women have become possessed with a special passion for the physician who hypnotizes them.

In this case the *post hoc, ergo propter hoc*, is very doubtful.

It has been previously mentioned that the irritability for hypnotic stimuli gradually increases when the experiments are repeated.

Hence it might result that occasionally involuntary hypnosis occurred.

The experience gained since then shows that this increase only reaches a certain degree, and rapidly goes again, if for a period all experiments are left off. Hence it is advisable, in cases where unpleasant increase of irritability remains after hypnotic experiments, simply to break off the experiments.

My experience of the persons upon whom I have chiefly experimented speaks, moreover, in favour of the fact that such an inconvenient increase will very seldom be met with, for I have only met with one accidental hypnosis.

From the above statements, it would seem that there is no ground whatever to objections against hypnotic experiments.

Have not many medical men (Hufeland and Reil among others), in the first decade of this century, magnetized, for curative purposes, many thousands of people?

Such an extension of magnetizing in the hand of cautious and conscientious physicians would be inconceivable, if it were accompanied by evil after results.

On the contrary, it appears that, in certain maladies, the hypnotic sleep does good. At any rate, Demarquay and Giraud-Teulon,* surgeons of reputation in the medical world, state that, in cases of neuralgia in hysterical women, the hypnotic sleep removed, for at least twenty-four hours, the torturing pains, whilst opium and chloroform were ineffectual.

A similar statement is made by M. Ch. Richet to me.

However, it would be advisable to continue to use the same caution hitherto used, especially not to keep up an experiment for longer than a few minutes; and, with such people as present any long-continuing change in nervous irritability, or even traces of such a change, it would be advisable to discontinue the experiments.

Observations on hypnotism will doubtless, in future, be quite as harmless as hitherto, if these rules be kept.

But it must be remembered that the necessity for the latter has not arisen as the result of unfavourable experience, but merely because it is our duty, for the sake of the person experimented on,

* "Recherches sur l'Hypnotism," Paris, 1860, p. 19. With regard to fears concerning hypnosis, the authors express themselves thus: "Dans cette série d'experimentations nouvelles, nous n'avons pas eu l'ombre d'un accident à déplorer." They give, however, one case which frightened them. A lady began, in a condition of hypnotic hallucination, to tell aloud secrets which compromised her exceedingly.

to adopt too great, rather than too little, precaution.

I would also warn non-medical people from making these experiments; for they can be put into a position of great embarrassment, if they should meet with cases in which the hypnosis begins with general convulsions, as in the two cases above communicated.

The unusual spectacle could easily deprive the experimenter of the presence of mind necessary for putting an immediate end to the experiment.

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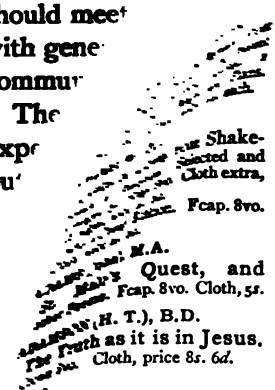

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